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ALUMINUM CONDUCTORS.

A letter published this week from a member of the firm of engineers which installed the Calgary plant, to which reference was recently made, throws some light on the financial factors that govern and dominate modern engineering. The object sought by the trained engineer working in the interest of his clients is to furnish a plant of maximum net earning capacity. The underlying purpose of the promoter or underwriter is to furnish a plant which will ostensibly justify the maximum amount of securities from the sale of which profit can be made. These two objective points lie in different directions, and it is consequently little wonder that seemingly inconsistent designs, to which our correspondent makes feeling reference, are sometimes carried out. It is this fact which has caused our frequent references to the wise policy of government control in the case of development of powers on public domain. The fundamental thing is to force such a development of these powers as shall produce the minimum capital charge consistent with sound engineering. The practical economy of hydroelectric transmissions lies in keeping down the fixed charges, which take the place of fuel consumption in a steam-driven plant; and if the government regulates wisely the developments of its water-powers, this fixed charge can be kept so low as to insure both a liberal return on the capital actually invested and a moderate price to the consumer.

But this is an aside, for the main feature of interest in the Calgary plant was the extensive use of aluminum conductors, and our correspondent notes that his firm alone in the last four years put in 1100 miles of single circuit in aluminum conductors, amounting in all to about 3000 tons of the metal. With the exception of 60 miles, all this construction is in Canada, which is somewhat suggestive, since the Canadian duties are less formidable than those on our own side of the line, and, since these seem to regulate the price of aluminum, that metal is more economical in Canada than here. Indeed, we should be little surprised to find that American manufacturers would actually sell to Canadian consumers cheaper than to their own countrymen, as is the case in so many heavily protected industries. Be that as it may, our correspondent's experience, which includes lines at the highest working voltages and in very severe climates, shows plainly enough the possibilities of aluminum lines whenever the metal can be purchased to advantage. Particularly interesting is the statement, based on large experience, that stringing the lines is on the whole cheaper for aluminum than for copper. This being so, the use of aluminum may fairly be said to turn wholly on the manipulation to which the selling price is subject. It has not yet been made evident whether there is a community of interest between the copper producer and the aluminum

producer sufficient to produce the present situation, but it is a subject which deserves looking into and on which we hope more light will be thrown. Certain it is that with aluminum at foreign prices, or reasonably near them, its use for power transmission lines would very greatly increase; and since the cost of line is a considerable item in the capital charges in long transmissions, the desirability of reducing it by the use of aluminum is self-evident. It is a wonderful metal, deserving of far greater employment in many ways than it has yet reached.

ELECTRICAL FEATURES OF A REMODELED OFFICE-BUILDING PLANT.

An electrical lighting and motor load in a single group of office buildings which has reached such enormous proportions as to render service at 120 volts economically disadvantageous and to indicate the necessity for a three-wire, 240-volt system is one well worthy of record in our columns. Moreover, space limitations which preclude the installation of a direct-control switchboard and dictate the use of remote control for such an equipment are so unusual as to be classed as unique. The change from a 120-volt, two-wire, direct-control system to a three-wire, 240-volt, remote-control system, while maintaining uninterrupted service at all important points, is an accomplishment of no small interest. The arrangement of underfloor office-lighting circuits in such a manner that any desired changes can be made in the location of the office furniture at the minimum of expense and without damage to the appearance of the floor is a feature which will be appreciated at once by all wiring contractors and office-building owners. The above represent some of the many interesting features of the electrical equipment of the office buildings of the Prudential Insurance Company, which is described at length in an article by Messrs. Henry C. Meyer, Jr., and Bassett Jones, Jr., the first instalment of which appears in this issue.

It is not usually considered difficult to design a complete new electrical generating, transmitting and distributing equipment for localized service. However, the problem assumes an entirely different aspect when it is coupled with the necessity of maintaining an existing service uninterrupted, of utilizing existing equipment to the fullest extent economically possible, and of installing the new equipment in such cramped space as is available for the purpose after all other demands for space have been met. A simple solution of the problem would be to enlarge the present equipment to carry the increased load. In the case of the Prudential installation a careful study of the conditions showed that the cost of extending the plant according to the existing arrangement would be prohibitive, a better and highly satisfactory solution of the numerous difficulties being found by resorting to the remote-control, three-wire arrangement. In carrying out the plans adopted the difficulties actually encountered were more largely mechanical than electrical, on account of the presence of other equipment, especially a multiplicity of ducts and pipes in the space where the electrical conduits could best be located.

A complete study was made of the existing distributing circuits, ducts and pipes, and working drawings in detail were prepared preliminary to the actual work of reconstruction, but subsequent to the letting of the contracts for the work. In this way the major difficulties which would otherwise have arisen on numerous occasions were avoided. Many of the minor difficulties encountered were of such a character that they could not be specifically predicted before the work was begun. It was necessary, therefore, to plan for some of the reconstruction while the work was being done. To the hearty co-operation of the consulting engineers, contractors, architects and manufacturers for the ultimate benefit of the owners can be attributed the results obtained in the Prudential plant, to which all parties interested now point with pardonable pride.

WATER AND STEAM POWER.

Apropos of the important article by Mr. Dunham on which we commented in the New Year's number some further considerations arise which are worth discussion. Mr. Dunham's long experience in the use of transmitted power gives his opinion on the economic side of the matter great weight. His was one of the very first plants in the country to use transmitted power to any extent, and his results as now stated are merely confirmatory of those established at least a decade ago; for, if we recollect aright, in the litigation between the Holyoke Water Power Company and the city of Holyoke, about ten years since, figures from the Hartford plant were presented showing substantially the results just given, so far as the relatively high cost of the water-power goes. It is a question, however, whether a plant like that at Hartford, or like several others of those mentioned, can fairly be called a transmission plant with steam auxiliary at all; for the fact is that the tail has come to wag the dog, so that installations of this class should really be regarded as steam plants with auxiliary water. As such, one must regard them as showing a high degree of economy, although the use of steam is very large. The Hartford plant, for example, is one of the most successful from a business point of view in the country. This, of course, is largely owing to the very broad and remarkably far-sighted policy which its venerable owner has pursued for many years, but such a success could not have been reached without a well-planned and economical equipment.

The other cases cited by Mr. Dunham are of a somewhat similar character. They may be regarded as plants with more or less important hydraulic auxiliaries. In other words, when a power is developed up to three or more times its minimum capacity, including storage, its projectors must deliberately depend on selling steam-produced power for a considerable part of the year, while keeping down the average cost by using their water-power when it is available. Such a combination may pay or not according to the circumstances; but whenever the cost of steam-power can be brought down to the point now reachable without much difficulty auxiliary water-power reduces the operating expenses in a most gratifying manner. The obvious moral seems to be that wherever a steam-power alone would stand a reasonable chance of showing the balance on the right side of the books the addition of a

hydraulic auxiliary intelligently installed, with its remarkably low operating cost, is extremely desirable, although one cannot expect to keep his entire output down to the cost of that which would be produced by the hydraulic auxiliary alone under more favorable circumstances. Of the world's total supply of water-powers a good many will have to be utilized in just this way, more and more, as the value of the combination is better understood.

On the other hand, it must not be forgotten that, if the topographical conditions are favorable, water storage can be carried far enough greatly to lessen the need for steam auxiliaries, and the greater the extent to which hydraulic plants are organized into networks the less need of using even cheap steam-power for purposes of protection. Results like those presented by Mr. Dunham, valuable as they are for the class of powers to which they have immediate reference, must not be considered as showing unfavorable economic conditions for water-powers in general. Every decrease in the cost of producing steam-power means a narrower margin between it and water-power, between the transportation of coal to the station and the transportation of energy from the station. Nevertheless, where water storage is available the hydraulic plant will continue more than to hold its own against the very best that steam can do even with cheap fuel. There will always be two distinct classes of hydraulic plants, however much they may merge into each other at the point of contact—first, those which are primarily hydraulic, not developed for power greatly in excess of what they may be able to furnish with carefully planned storage, and, second, plants in which, from the nature of the market and the water supply, steam must be the predominant factor in supplying the power market. The conditions of maximum economy in either class are best met by consolidation into large networks whenever practicable. For the diversity factor applies just as forcefully to a group of plants as to a single plant, and a system composed of a considerable number of generating stations can be so organized as to take full advantage of the diversity factor and obviate the necessity of heavy insurance in the way of steam plants; or, what amounts to the same thing, it then becomes easy to obtain the maximum possible use of the hydraulic portion of the plant whatever amount of steam assistance may be required.

LOGARITHMIC CHART FOR CALCULATING THE FREQUENCY AND WAVE-LENGTH OF OSCILLATING-CURRENT CIRCUITS.

In dealing with oscillating-current circuits for wireless telegraphy the relations between inductance, capacity, frequency and wave-length are perpetually in evidence, and, from a numerical point of view, are difficult to keep in mind. The formulas in themselves are simple enough; but the continual recourse to pencil and paper for the computation of the required co-ordinate relations becomes burdensome after a time. For example, an easily remembered relation between the wave-length and the inductance and capacity of a resistanceless oscillating-current circuit is that the wave-length, in centimeters, is the periphery of that circle whose radius is the geometric mean of the inductance and the capacity, both the inductance and the capacity being taken in centimeters. The frequency is then the velocity of light divided by the wave-length so found. Easy as these relations are to be remembered, their repeated valuation soon becomes wearisome. In order to simplify the technique of evaluating these relations arithmetically, Mr. R. H. Marvin has worked out an alignment chart, which appears on page 99 of this number. It consists of three parallel lines, the middle line being equidistant from the outers. Logarithmic scales are marked off along these lines. It is evident that a wave-length, being a geometric mean between inductance and capacity, will be logarithmically an arithmetical mean between those quantities, when both are laid off logarithmically. Consequently, by locating the scales correctly, the wave-length will lie on the middle line half way between the positions of the component inductance and capacity; or, a straight line connecting these components will intersect the middle line at the resulting wave-length. Again, since the wave-length and the frequency are in reciprocal relation, their logarithms will have a constant sum; or, when laid off on logarithmic scales, these scales may be placed side by side in mutually opposed directions. The position obtained by a straight-edge for the central line on the wave-length scale is thus also the position for the same line on the frequency scale.

A convenient application of the chart is finding the sequence of inductance-capacity components that will serve jointly to produce one and the same frequency or wave-length. By rotating the straight-edge about that frequency as center, the successive pairs of components are shown at once on the outside lines. For frequencies beyond the range of 100,000 to 1,000,000 cycles per second the chart can still be used, although only indirectly. The chart is, in reality, a kind of slide rule, in which the only thing that has to slide is a straight-edge in the hands of the manipulator. This makes a very simple and inexpensive device, when mounted on a flat card or sheet of celluloid. It is also evident that such a chart might be harnessed into service for tuning an oscillatory circuit to a given frequency by arranging two sliders along the outside lines in such a way that at any given position of the slider on its line the particular corresponding value of inductance or capacity marked thereat should automatically be brought into circuit by a lever system acting on coils in the one case or condensers in the other. Thus arranged, the two sliders could be moved side by side along their lines by a common cross-bar, and the bar would indicate from point to point, on the middle line, the corresponding frequency and wave-length. A simpler arrangement to execute would be to arrange, either for an inductance slide or a condenser swing, or both, a mechanical link such that a pointer would mark off on one line of the chart the existing value of the variable. An elastic band connecting the two pointers would then intersect the central line at the corresponding frequency and wave-length. Incidentally, it may be noticed that the setting of the two logarithmic scales for wave-length and frequency respectively, appearing on opposite sides of the central line in the chart, can always be obtained on an ordinary Mannheim slide rule by taking out the slide and inserting it reversed. In the absence of such a chart the co-existing relations of wave-length and frequency may thus be presented to the eye with an ordinary slide rule.

MR. EDISON'S VISIT TO CHICAGO.

After an absence of nearly nineteen years, Mr. Thomas A. Edison revisited Chicago last week, and he was received with great cordiality and enthusiasm by electrical men and the press and public. His principal object was to attend the Byllesby convention and banquet, but he also managed to see many other persons and things in a period of less than two days and during extremely cold weather. He arrived about noon on Friday, Jan. 5, accompanied by his wife and daughter, and was met at the train by electrical friends and escorted to the Blackstone Hotel. During the afternoon he visited the Byllesby convention in the Congress Hotel, where he received an ovation, and also, escorted by his old associate and friend, Mr. Samuel Insull, made a trip to the generating stations of the Commonwealth Edison Company. During the afternoon Mrs. Henry M. Byllesby gave a reception at her Drexel Boulevard home in honor of Mrs. Edison and Miss Edison. In the evening the great inventor was the chief guest at the Byllesby banquet, as related elsewhere.

On Saturday morning the distinguished visitor conferred with some of the steam-railroad executives of Chicago in relation to the possible electrification of railroad terminals by means of electric locomotives or motor cars operated by storage batteries. Later he made a number of social calls in the financial district, accompanied by Mr. Insull, and met a number of the presidents of the principal banks and trust companies. A luncheon given in his honor at the Chicago Club by Mr. Insull followed, and this was attended by sixty of the leading men of affairs in Chicago, including the Governor of the State of Illinois and the Mayor of Chicago. This was a notable gathering of prominent men, and all united in an eager desire to do honor to Mr. Edison. The visitor spent the afternoon at the club chatting with friends and acquaintances, and in the evening he, with Mrs. Edison and Miss Edison, was entertained by Mr. Insull at a private dinner which was given at the Blackstone Hotel owing to the absence of Mrs. Insull from the city. On Sunday morning Mr. Edison and family departed for their home in Llewellyn Park, N. J. The unassuming friendliness and kindly manners of the greatest of living inventors made a very pleasant impression on his friends in Chicago, old and new.

Western Association of Electrical Inspectors.

At the annual meeting of the Western Association of Electrical Inspectors, to be held at the Pankinton House, Milwaukee, on Jan. 23, 24 and 25, addresses and reports will be delivered as follows: *Outside Wiring*, Mr. Waldemar Michaelson, Omaha; *Underground Systems*, Mr. Hugh T. Wreaks, New York; *Protection of Buildings Against Lightning*, Mr. H. B. Long, Nashville, Tenn.; *Electric Traction Systems*, Mr. Frank R. Daniel, Indianapolis; *Grounding of Conductors and Conduit*, Mr. W. J. Canada, Denver; *Electrolysis*, Mr. W. G. Middleton, Chicago; *Reminiscences of a Pioneer Electrical Inspector*, Mr. Franklin H. Wentworth, Boston.

In addition there will be an address by Mr. Victor H. Tousley, of Chicago, president of the association; a report by Mr. William S. Boyd, of the same city, who is the secretary and treasurer, and general discussions of the regulation of the electrical hazard during the year and problems that arise in electrical inspection work. On the evening of Jan. 23 there will be a complimentary dinner to members, and there will also be visits to the shops of the Allis-Chalmers Company and the Cutler-Hammer Manufacturing Company. A number of those attending the convention will go from Chicago on the 6:30 p. m. train of the Chicago, Milwaukee & St. Paul Railroad on Jan. 22.

Incandescent Lamp Case.

It is reported that the incandescent-lamp manufacturing companies and associated companies of the National Electric Lamp Association that were defendants in the recent suit brought by the government for violation of the Sherman anti-trust law have been granted an extension until April 12 to comply with the terms of the decree entered in the United States Circuit Court on Oct. 12, 1911, by Judge Killits, of Toledo. As explained at length in the *Electrical World* of Oct. 21, 1911, the decree, among other things, ordered the dissolution of the National Electric Lamp Company and enjoined the General Electric Company, owner of the National Electric Lamp Company, from carrying on an incandescent-lamp business except under its own name. To comply with this order requires extensive business rearrangements, and the court has granted the lamp people an extension of time for this purpose.

PROPOSED BOSTON ELECTRIC GARAGE.

At the first meeting of the Boston Electric Vehicle Club this year, which was held in the Edison Building, Boston, on Jan. 3, plans for an all-electric garage and sales building were discussed. Mr. J. S. Codman, of S. R. Bailey & Company, Boston, chairman of the committee on an electric-vehicle building, submitted sketches of an eight-story structure to occupy a plot of 12,000 sq. ft. in the outer Back Bay district, the preferred location being the vicinity of the intersection of Commonwealth Avenue and Beacon Street. As tentatively planned, the building will contain ten 25-ft. by 40-ft. offices and salesrooms on the street floor, flanking a central arcade bordered with plate-glass windows, a basement garage of the most modern type for the handling of electric trucks, and upper stories containing offices, garage space and depots for electric pleasure vehicles, batteries and accessories. The estimated cost of the building is about $200,000. Two high-powered automobile elevators will be installed, and the establishment will be planned to afford the utmost facility to seekers after information, owners and prospective buyers of electric machines. President Baker emphasized the point that if such a building is erected in Boston it will give an impetus to the electric-vehicle movement that will be felt all over the country. The proposed location is near the business district of the city and at the same time in remarkably close touch with the great suburban park area which offers unexcelled attractions to motorists. Mr. Converse D. Marsh, New York, said that the completion of the project would be a centralization and "dignification" of the business which would be of the utmost value.

MEETING OF BROOKLYN COMPANY SECTION, N. E. L. A.

The Brooklyn Company Section of the National Electric Light Association held a very enthusiastic meeting on Jan. 8. The chief speaker of the evening was Congressman W. Redfield, who compared industrial conditions in the Orient with those in the Occident. Mr. Redfield visited Japan, the Philippines, Hong Kong, Java, the Straits Settlements, Burmah and other parts of India, for the purpose of studying conditions of trade in those markets, and spoke entertainingly of the labor situation in the countries visited. He impressed upon his hearers the fact that conditions in the Orient are now in a state of transition, and what is true of the industries there to-day will not be so to-morrow. He also pointed out the futility of judging the Mohammedan, who, although excelling in metaphysics and logic, has no conception of time, by American standards.

Mr. W. F. Wells, general superintendent of the Brooklyn Edison company, followed with a thoughtful paper on profit sharing and investment funds. By means of a large chart he showed how small amounts regularly set aside at compound interest grow to huge figures in time, and how if profits such as are given by the Brooklyn Edison company are similarly invested one need not worry about means of support in old age. Mr. Wells said that the employees of the Edison Electric Illuminating Company of Brooklyn now had $158,000 invested in the securities of the company. The last speaker was Mr. T. I. Jones, general sales agent, who briefly reviewed the work of the year and illustrated by stereopticon some of the more interesting installations made by the company during the past year. He also explained some of the newer forms of contracts or contract riders got up by the company to meet special classes of customers. The attendance was about 500.

HYDROELECTRIC FEATURES OF LAKES-TO-THE-GULF DEEP WATERWAY PROJECT.

The speaker at the luncheon of the Electric Club of Chicago on Jan. 3 was Mr. Isham Randolph, who has paid particular attention to waterways and who was chief engineer for the Sanitary District of Chicago for several years during the period when the Chicago Drainage Canal was under construction. Mr. Randolph spoke on "The Lakes-to-the-Gulf Deep Waterway." He said the Chicago Drainage Canal was the largest artificial waterway in the world when it was completed, but it will soon be overshadowed by the great Panama Canal. Its channel now connects the South Branch of the Chicago River in Chicago with the Desplaines River at Lockport, Ill. There is thus a deep waterway in existence connecting Lake Michigan with one of the tributaries of the Illinois River and so with the Mississippi River and thus to the Gulf.

For several years there have been zealous advocates of the plan of deepening the Desplaines, Illinois and Mississippi Rivers so as to make a waterway connecting the Great Lakes and the Gulf of Mexico and having a uniform depth of possibly 14 ft. From Lockport to Utica, Ill., the latter place being the present head of navigation on the Illinois River, is a distance of 62 miles, and there is a drop of 100 ft. in this distance. It is proposed to construct a channel in or adjacent to the Desplaines and Illinois Rivers to connect these two points. Such a channel would have several locks and a minimum width of 300 ft., with a proposed depth of 14 ft. There are four sites where water-power might be developed, and the net head for all four of the sites is 88 ft. With 14,000 cu. ft. of water per second flowing through this waterway Mr. Randolph has calculated that about 105,000 net electrical horse-power could be developed at the four sites available.

In 1908 the people of the State of Illinois voted for a constitutional amendment permitting the State to issue bonds to the amount of $20,000,000 to build the Lockport-Utica waterway. Illinois politics has prevented, however, the carrying of this plan into execution. It has been calculated that the revenue from the water-power would pay back in eighteen years the money expended in building the waterway. The deepening of the Illinois River from Utica to the Mississippi at Grafton, Ill., and the deepening of the Mississippi from there to the Gulf must be carried on by the national government. Congress has not done anything on the subject, however, although President Taft referred most encouragingly to the project in a recent message.

A 14-ft. channel can be maintained in the Illinois and Mississippi Rivers from Utica, Ill., south without a single dam. The maintenance of the waterway from Utica to Grafton, a distance of 290 miles, would cost, it is estimated, about $25,000 a year, as there is little sediment in the Illinois River. But in the Mississippi, from the mouth of the Illinois to the Gulf, it is estimated that the annual maintenance of a 14-ft. waterway would cost $6,500,000. Between Cairo, Ill., and deep water there are thirty-six bars, and the channel of the river is constantly changing. The remedy is to provide hydraulic dredges to be in constant service, cutting through the bars as they form.

BATTERY OPERATION FOR RAILROAD TERMINAL ELECTRIFICATION.

The visit of Mr. Thomas A. Edison to Chicago on Jan. 5 and 6 served to revive the talk of railroad terminal electrification by means of storage-battery locomotives or motor cars, or both. The subject was discussed unofficially at the recent Chicago convention of the Association of Railway Electrical Engineers, as related in an article on the subject in the *Electrical World* of Nov. 18, 1911, page 1227. Mr. Edison is believed to be convinced of the practicability of battery-driven locomotives and battery-driven cars for heavy railroad work. While in Chicago he had a conference with Illinois Central and other steam-railroad men on the subject, and they listened to his views with respect and attention, although the proposal involves a radical change from any existing electrically operated terminal. Mr. C. H. Markham, president of the Illinois Central Railroad, is reported to be making a careful and earnest study of the practicability of the various methods of terminal electrification proposed for his company's lines in Chicago, and he is said to have an open mind toward the storage-battery proposal. Mr. S. M. Felton, president of the Chicago Great Western Railroad, is also reported to be investigating battery-operated cars, and it is said that preliminary tests will be made on the Waverly (Ia.) branch of the road, which is 22 miles long.

Battery locomotives or cars could use the present track without any contact rail or overhead construction, and could interchange from one road to another. Where locomotives are used the tender could contain the storage cells. Battery-operated motor cars could be used for the suburban service in large cities. It is reported that Mr. Edison recently made an improvement in his nickel-iron storage battery that will materially reduce the time required for charging. If this be true, the fact would have an important bearing on the possibility of using storage battery locomotives and cars within the practical limits of economy in operation.

NEW YORK AUTOMOBILE SHOWS.

During the present week no less than three automobile shows opened in New York City, two of which are still running—one the Importers' Automobile Salon, in the grand ballroom of the Hotel Astor, Jan. 2-10; another, the National Automobile Show, at Madison Square Garden, Jan. 6-20, given under the auspices of the Automobile Board of Trade, and a third managed by the National Association of Automobile Manufacturers, in the New Grand Central Palace, Jan. 10-17. The shows in Madison Square Garden and the New Grand Central Palace are no longer competitive, as heretofore, owing to the friendly relations existing between the Automobile Board of Trade and the older National Association of Automobile Manufacturers. The show at the Hotel Astor consisted chiefly of high-class imported cars, with no electrics, while the other two great shows have electric pleasure cars on exhibition, although somewhat difficult to find. It is doubtless due to this tendency on the part of the promoters of the great automobile shows to relegate the electric vehicles to some obscure

corner that many of the well-known makers of electric vehicles are absent from both shows.

During the present week the following manufacturers of electric vehicles are represented at the show at Madison Square Garden, the first week of which is devoted to pleasure vehicles: Anderson Electric Car Company, Baker Motor Vehicle Company, Flanders Manufacturing Company, Grinnell Electric Car Company and the Waverley Company. At the automobile show in the New Grand Central Palace are the following manufacturers of electric vehicles: Argo Electric Vehicle Company, Columbus Buggy Company, Hupp Corporation, Ohio Electric Car Company, Standard Electric Car Company and the Walker Vehicle Company. Next week at Madison Square Garden, when commercial vehicles will be on exhibition, the following manufacturers will be represented: Anderson Electric Car Company, Baker Motor Vehicle Company, Bronx Electric Vehicle Company, General Motors Truck Company, General Vehicle Company, Studebaker Auto Company, Ward Motor Vehicle Company and the Waverley Company.

There are no startling innovations in any of the electric vehicles, but the gasoline automobile industry during the past year has striven to meet one of the great talking points against the gasoline machines by evolving self-starters, rendering the cranking of machines unnecessary. Over sixty manufacturers of gasoline machines will equip their cars with self-starters during the coming year. The systems of self-starters at present evolved are as follows: Compressed-air starters, explosive-gas starters, electric starters, spring starters, lever and pedal starters and primers. Most of the explosive starters use a mixture of acetylene gas and air, which is ignited in the usual way. In the electric starters a combined motor and generator operates either as a motor or generator, depending on whether it is being used for starting or for igniting the charges and lighting the lamps. For starting the engine the generator is temporarily and automatically transformed into a motor, the energy required to operate it as such being furnished by the storage battery. As soon as the engine takes in charges of gas and commences to run on its own power the operator releases the clutch which disengages the electric motor gear from its connection with the flywheel, and the motor then again becomes a generator, its energy being devoted to ignition and to charging the storage battery. The other starters are mechanical in their operation. The greater part of the self-starters in use are of the explosive-gas type. Only a few of the cars are fitted with self-starters of the electric type.

The electric generator outfits for lighting have also met competitors by the introduction of improvements in the acetylene lighting equipments whereby a single switch-turning movement from the seat turns on the gas and ignites the acetylene lamps. Small gas tanks holding sufficient acetylene gas in storage for from one to two months' lighting, or for 3000 engine starts, are now stated to be available throughout the country. The tanks when empty can be returned and a fresh tank attached for a nominal fee. Self-starting attachments are also coming into vogue among the commercial vehicles. The application of self-starters to gasoline machines is the most prominent feature of the year, which manufacturers claim will be long known as the "self-starter year."

Maximum Output of 200,000-kw in Chicago.

On Thursday, Jan. 4, 1912, the maximum output of the Commonwealth Edison Company, of Chicago, reached the figure of 201,630 kw. This is the largest maximum output in the history of the company and is of especial interest because it marks the passing of the 200,000-kw mark, which has been looked forward to for some time. It reveals the remarkable expansion of the company's business to recall that only three years ago the company passed the 100,000-kw mark, while it is only ten years ago that it passed the 20,000-kw mark. It is probable that the Commonwealth Edison Company has reached the largest maximum output and also the largest kw-hour output of all the electric-service systems in the world.

THE BYLLESBY BANQUET IN CHICAGO.

Thirty years ago, as a young man who had just left college, Mr. Henry M. Byllesby was one of that band of youthful enthusiasts employed by Mr. Thomas A. Edison in his great work of developing methods of generating and distributing electrical energy. Many of Mr. Edison's assistants have risen to prominence in the electrical industry, and Mr. Byllesby is one of these. His large organization of engineers and managers of public-utility properties celebrated its tenth anniversary by a grand banquet, which was the culmination of the third annual convention of the Byllesby organization and affiliated companies. This banquet was held on the night of Jan. 5, 1912, in the Gold Room of the Congress Hotel, Chicago, and was a notable and brilliant affair.

Mr. Edison was the chief guest among many prominent men. Doubtless it was a proud moment for Mr. Byllesby when he sat with Mr. Edison on his right and Mr. Charles A. Coffin on his left and faced a gathering of over 400 men, many of them men of mark, assembled to do honor to the organization he has built up. Mr. Samuel Insull, one of the most zealous of Edisonians, sat at Mr. Edison's right and was the latter's lieutenant and spokesman. Mr. B. E. Sunny, as an old-time friend, supported Mr. Coffin on the left.

Among the other gentlemen present, in addition to the speakers to be mentioned later, were engineers and economists like Mr. Horace G. Burt, Prof. J. L. Laughlin, Mr. W. J. Hagenah, Dr. W. F. M. Goss, Messrs. E. W. Rice, Jr., Frederick Sargent and Bion J. Arnold; financiers like Messrs. Charles L. Hutchinson, F. D. Stout, John J. Mitchell, Byron L. Smith and Henry A. Blair; lawyers like Mr. John S. Miller and Mr. William G. Beale; railroad presidents like Mr. A. J. Earling and Mr. S. M. Felton; merchants and manufacturers like Messrs. LaVerne W. Noyes, A. C. Bartlett, J. R. McKee and James Simpson; public-service administrators like Gen. George H. Harries, Messrs. A. S. Huey, Louis A. Ferguson and John F. Gilchrist, and publishers like Messrs. Victor Lawson, H. H. Kohlsaat and Hugh M. Wilson.

Special decorations enhanced the attractions of the handsome hall. Directly opposite the long speakers' table was a facsimile of the signature of Thomas A. Edison, standing out from the front of the balcony in the light of incandescent lamps. The balcony railing extending around the room was concealed in a mass of greenery, and at intervals the names of prominent electrical scientists and inventors, like Faraday, Henry, Siemens, Westinghouse, Sprague, Thomson and others, were spelled out in electric light. At one end of the hall was an electric-light design consisting of the monogram "H. M. B.," surrounded by the words "Engineers, Managers" and "Tenth Anniversary." Above the balcony, on the walls, were gracefully festooned American flags and the banners of the states. Flowers, ferns and smilax were in profusion on the tables. A number of ladies, including Mrs. Edison, Miss Edison, Mrs. Byllesby and others, occupied seats in the balcony, and while the dinner was in progress Mr. Frank H. Jones arose and proposed a toast in their honor, which was drunk with enthusiasm.

The dinner was luxurious in all its appointments. One of the courses was pheasant, and before it was served there

appeared a procession of trumpeters followed by cooks who bore in triumph a group of mounted pheasants, which, after a tour among the tables, was finally deposited, with a flourish, in front of the host. A crackling "wireless" outfit in the balcony demanded frequent attention, and a number of amusing mock telegrams were read. Instrumental and vocal music by talented performers as well as chorus singing added to the enjoyment of the evening.

Mr. Byllesby was the toastmaster, and he introduced as the first speaker Governor Adolph O. Eberhart, of Minnesota, who made a clever and witty speech. Contrasting electrical work and political activity, he said that, instead of transformers, they have in Minnesota reformers, both step-up and step-down. Again, it may be noticed that if you knock "l" out of volts you have votes. The Governor praised the development work of H. M. Byllesby & Company and said that the "electricity-on-the-farm" movement would do much to stop the migration of country boys to the city. He said that every business concern would get fair treatment in Minnesota, and that he believed in that kind of conservation of natural resources that permits this generation to get its fair share of the benefits of conservation.

A number of letters and telegrams of regret were read. One was from Mr. N. W. Harris, who said that Edison had done more for mankind than any other living man. Mr. Harris' firm alone has purchased over $500,000,000 of bonds based on the inventions of Edison.

Mr. Byllesby next proposed a toast to Mr. Edison, with a fine tribute to him as a man and an inventor. This toast was drunk standing, with great cheering and enthusiasm. As Mr. Edison does not make public speeches, Mr. Insull responded for him, saying that, as the guest of honor could not hear what was being said owing to his deafness, he (Mr. Insull) felt no embarrassment in declaring his conviction that Edison is "the greatest private citizen of the race to-day." The speaker sketched briefly the remarkable achievements of his old chief and read the following, which Mr. Edison had written down at Mr. Insull's request as a message relating to the future:

"Within a comparatively short time coal will be virtually unknown as an article of common usage. It will become more of a curiosity. Stored in vast power houses, its energy will be thereby disseminated.

"As the electric motor has but one movement—rotary—the time is coming when the electric motor will move the world.

"In a few years all of the railroad terminals of this country will be electrified. The main lines of railroad systems in mountain regions where there is water will also be electrified, and ultimately all lines of railroads will be propelled by this motive power.

"The time is not far distant when all traction vehicles will be operated by electricity."

Mr. Insull commended Edison's example to young men, speaking particularly of his perseverance, which all may emulate. He read the following message to young men, written by Edison: "When you get a job pitch in for all you're worth. Pay no attention to time. Forget that there is a clock. Work hard and become more interested in your work than the old man. Talk nothing but shop, and some day when you want to leave the old man won't let you. Instead, he will take you into partnership."

Rev. Herman Page, D.D., of Chicago, spoken of by the toastmaster as the chaplain of the Byllesby organization, responded to the toast "Light and Power," alluding to men who invented and developed electric lighting as the torch-bearers of civilization.

Mr. Charles A. Coffin, of New York, president of the General Electric Company, was introduced by Mr. Byllesby in a speech linking him with Mr. Edison as two great Americans. Mr. Coffin spoke warmly of Edison's great work and dwelt on the importance and beauty of work. He praised the Governor of Minnesota for his enlightened views and said that other public men might pattern after him. He also paid tribute to Mr. Insull for the skill, genius and foresight exhibited in the extraordinary engineering and financial triumph shown by the scientific manufacture, distribution and sale of electricity in Chicago. The speaker commented also on the wonderful capacity for organization shown by Mr. Byllesby. He remarked on the high position of American electrical securities, and said that the markets of the Old World and the New World are already competing for these securities.

Mr. Charles G. Dawes, president of the Central Trust Company of Illinois, spoke on "The Attitude of the American Business Man Toward Present Issues." His speech was a spirited appeal for fair treatment of the leaders of industry—the men who have power to put wealth in motion. These men, he said, have to account to investors more strictly than political agitators have to account to voters. The present agitation against restraint of trade is not an attack on corporations, but on industry itself as now organized. Mr. Dawes defended the Chicago meat packers, now on trial for alleged violation of the Sherman law, who have been attacked unfairly, he said. The American business man must enter politics. Further, there must be some way by which an honest man may know what restraint of trade is lawful and what is unlawful.

Mr. George M. Reynolds, president of the Continental and Commercial National Bank of Chicago, made the last speech of the evening. His subject was "Keeping Up with the Times," and he voiced an appeal for old-fashioned thrift, simplicity and good sense. Toil and patience, the simple life, the creation of a sane public sentiment—such qualities as these are needed to solve the problems of modern existence.

THE BYLLESBY CONVENTION.

The tenth annual convention of H. M. Byllesby & Company, engineers and managers, was held in the Florentine Room of the Congress Hotel, Chicago, Jan. 2 to 5. Nearly 300 persons were present for the sessions, representing the executive, operating and engineering staffs of the Byllesby companies, which now furnish public-utility services in 192 municipalities in eighteen states. Mr. H. M. Byllesby, president of the company, opened the convention Tuesday morning with a welcoming address, which was mentioned in the *Electrical World* of last week.

On Tuesday afternoon, following a brief introductory address by the chairman of the convention, Mr. T. K. Jackson, of Mobile, Ala., the first paper on the program, "Steam-Heating Economics," was presented by Mr. A. E. Stevens, of Minot, N. D. After outlining the conditions desirable for an exhaust-steam-heating plant, average temperatures, seasons, coincidence of electrical and heating load-curves, compactness of community, cost of installing and operating plant, etc., the author described modern district-heating equipment, use of back-pressure valves, separators, by-passes, pressure boosters and other fittings. He also outlined the principles of the vacuum and simple back-pressure systems, stating the advantages and drawbacks of each. Mr. Stevens then discussed construction details of the outside piping plant, arrangement of cross-connections, choice of pipe sizes, provision for drainage, etc. He advocated the sale of steam heat on a metered basis, avoiding the waste usually found with flat rates. After all, he pointed out, the over-all operation of the plant must be considered, not its separate technical efficiencies. The gross steam-heating revenue from a station properly designed, he said, should equal 66 to 100 per cent of the cost of the coal burned; operation then becomes profitable.

In opening the discussion Mr. W. H. Brown, of Grand Forks, N. D., said that the back-pressure required in cold

weather too often exceeds 5 lb., sometimes reaching 8.5 lb., at a serious cost of engine efficiency. Mr. Samuel Kahn, of Bluefield, W. Va., observed that, himself an operator of a vacuum heating system, he could well recommend the straight-pressure system, for the complications of the former had proved very unsatisfactory. In analyzing costs of combined plants, he suggested that 1 lb. of coal be allowed for each 200 watt-hours generated, all over this being charged to the heating service.

Mr. H. Boyd Brydon, Chicago, said that the cost of furnishing steam heat must be analyzed carefully and may often be found to involve a loss instead of a profit. The investment in the plant, he said, may range from $7 to $10, and as high as $20, per foot of main. Mr. T. K. Jackson cited an instance where 3 deg. temperature drop in the outgoing mains, 2 deg. in the returns and the loss of 5 per cent of the water circulated in a hot-water system reduced the total efficiency 25 per cent. Mr. Stevens said that with a booster a former back-pressure of 12 lb. was reduced to 3 lb. Mr. W. F. Raber, of Pueblo, Col., estimated $7 per foot of main to cover the cost of mains, service taps, traps, meters, etc., in the average steam-heating plant. Mr. H. H. Jones followed with a paper on the "The Suburban Distribution of High-Pressure Gas."

Mr. H. E. Morton, of Albany, Ore., opened Wednesday morning's session with a discussion of "Ways and Means of Building Up Profitable Business in Small Towns Where the Investment Is Large." Besides rigid economy and the reduction of operating expenses to a minimum (although not, of course, to the injury of service), the author recommended imbuing each employee, in whatever capacity, with the spirit of the company—to make friends for it and to solicit for it all possible new business. Present consumers should be urged to take more service, residence customers being encouraged to use heating appliances and stores to extend their window lighting and to put in motor-driven machines, fans, etc. Such additional business avoids extra company investment and may therefore be very profitable. Display lighting can often be advantageously furnished on flat rates and motors rented or sold on payments, all to the end of increasing customers' consumption. The subject was discussed by Messrs. M. D. Spencer, Everett, Wash.; B. H. Cowperthwait, Faribault, Minn.; L. G. Gresham, Bluefield, W. Va.; R. J. Mack, Fort Smith, Ark.; H. L. Jackman, Eureka, Cal.; W. F. Raber, Ottumwa, Ia.; A. Larney, St. Paul, Minn.; E. L. Callahan, Chicago, Ill., and J. C. McGuire, Mankato, Minn.

"Points of Contact with the Public" was the title of the next paper, presented by Mr. W. H. Hodge, publicity manager for the Byllesby companies. Mr. Hodge cited examples of pleasant relations between corporation and public in communities where properties are operated under the Byllesby policy, earning generous and friendly treatment in return for courteous fair dealing to all. Such a public attitude cannot be valued too highly when questions of franchise rights, rates, extensions, improvements, etc., are up for action. The local company's character is largely personalized in its manager, who should be accessible to every customer. Pains must be taken to avoid fancied slights or annoyances to customers, and any patrons believing themselves aggrieved should receive every effort toward adjustment. Department meetings within the local company were also advised. In closing, the author said: "Because we operate monopolies we must treat our customers better than competitive business institutions, and we must make it plain to the public that such is the fact." Mr. W. B. McDonald, of Kalispell, Mont., objected to large-space newspaper advertisements which may wrongfully impress the public with the idea that the company is enjoying excessive profits. Instead, he said, modest space should be used and news stories given out regarding new plant improvements and extensions.

Mr. B. W. Lynch, of Bluefield, W. Va., in his paper entitled "The Accountant in Public Service Corporations," referred to the importance of the accountant's work in creating confidence in the company. Such accountants must be more than mere bookkeepers. Bills to customers should be issued regularly. Charges must be carefully classified under capital, construction, maintenance and operating accounts, and taxes should be apportioned under the monthly statements. Where a product of one department is used by another it should be charged for at cost, including all its elements. While this analysis is generally simple, it may become a little obscure in the case of steam-heating accounting.

Mr. Arthur Young, of Arthur Young & Company, certified public accountants, Chicago, said that the cost of getting new business may be treated under (1) current expenses, (2) debt to be wiped out during term of franchise, and (3) as a capital charge. Newspapers require heavy investments for securing circulation, but, having no term of franchise, consider this early expense as capital investment. For public utilities the two classifications last named are now favored by many state commissions, although, said Mr. Young, there appear to be advantages from writing off such debt during the franchise. Cost of securing future business, however, must not be confused with cost of holding present business. Mr. A. S. Huey, vice-president of H. M. Byllesby & Company, declared that the costs of securing business during unproductive periods should be capitalized.

Mr. George B. Caldwell, of the Continental and Commercial National Bank of Chicago, spoke next of the relation of banking to utility management and operation. Substantial properties operated by responsible men are now required to attract the interest of bond houses, he declared, for the days of quick sales and "unloading" at exorbitant profits are gone. Mr. Caldwell also referred to the increasing bond market afforded by Chicago, this business having grown tenfold in ten years.

Mr. Harold Almert, Chicago, cited an instance where a large investment made to secure new customers resulted in such an increase in business that the diminished cost of production soon paid for the expenditure. It therefore appears, said Mr. Almert, that one may be justified in assigning to capital charge almost any expenditure which increases the volume of business. Mr. N. I. Garrison, of Fort Smith, Ark., disagreed with the views already expressed, and presented examples of two companies in one of which superior brains and managerial ability alone had created a capital value of $100,000. The value of a plant may vary with the population it serves, so that efforts to increase that population may be properly chargeable to capital account, as, indeed, may be any other expenses which permanently increase its earnings. Mr. Henry Wilmering, Oklahoma City, Okla., advocated capitalizing all working assets, including expenditures for new business.

Mr. J. R. McKee, of New York, chairman of the power-transmission committee of the National Electric Light Association, next discussed the development of water-powers on public domains, quoting from the utterances of Mr. Walter Fisher, Secretary of the Interior, that official's views on regulation of water-powers and the rights of the federal and state governments. The present conditions of governmental water-power permits are unsatisfactory, but suggestions are welcomed by the Secretary and much progress has been made in the year past toward a broader view by the authorities and conservationists. Mr. F. Stearns, Chicago, traced the recent industrial trend, but showed that the fair position of the business interests is at last being presented to the public. Mr. F. V. Holman, of Portland, Ore., referred to the present broad application of the interstate-commerce law which seems to transfer many of the sovereign rights of the state to a mere centralized bureau. The speaker insisted on autonomy as a remedy for paternalism and socialism.

The rest of the afternoon session was given over to a "pow-wow," at which those present were encouraged to tell what had been done in their localities. Among the informal speakers were Messrs. T. K. Jackson, W. R. Molinard, H. L. Jackman, E. Holcomb, A. Larney, J. W. Gillette, W. F. Raber, H. H. Jones, H. I. Ward, C. M. Brewer and J. F. Owen, who spoke interestingly of results accomplished by their own companies during the last year.

Mr. W. R. Molinard, of Oklahoma City, Okla., opened Thursday's session with his paper on "Staff Co-operation Toward Better Relations and Increased Efficiency of Employees." The speaker compared the central station's organization with that of an army whose individual members are inspired with self-reliance, courage, cheerfulness and initiative. He also described welfare work for employees, and especially that done by the Oklahoma company in organizing its club. Mr. Molinard deprecated the award of bonuses to employees, objecting that men should not be rewarded for doing their simple duties. Employees' suggestions for improvements should be encouraged, he declared, and the line of promotion followed, where possible, within the organization. Mr. W. W. S. Butler, of Stockton, Cal., took exception to the "soldier" analogy, pointing out that central-station forces are recruited from the highest class of men. He also approved of encouragement and commendation of employees' work, accompanied by a liberal wage, not necessarily limited by the market value of such services.

Mr. Isaac Milkewitch, of the law firm of Cummins, Stearns & Milkewitch, Chicago, followed with a discussion of state and municipal jurisdiction over public-service corporations. In ancient times certain public callings were regulated because so scarce as to be monopolistic. Later all business became private and regulation ceased. With the revival of public callings or utilities the governmental regulative function has again become active. The right to regulate an industry does not depend on any use by it of a franchise, but is superior to such restrictions. Organized industrial giants should be regulated, said the speaker, and encouraged to expand and operate with increased efficiency.

Referring to appraisal work, Mr. Harold Almert, Chicago, explained its reasons and importance. He also defined "going value" or the "value of an established income." In some cases depreciation and obsolescence may be entirely overlooked, and the speaker gave an instance where a large property apparently in good financial condition and paying dividends had really been only returning its stockholders their principal in instalments and had meanwhile shrunk in value by several million dollars. Investments in utilities demand a fair return, considering their slight element of risk, since even farm loans fully secured now command 7 per cent. In closing, Mr. Almert said that the engineer should be a publicist actuated by the highest ideals for his profession, which, unlike other so-called "learned" groups, has naught to divert it from search of the clear, cold truth.

Mr. E. L. Callahan, Chicago, followed with a talk on new-business methods and representative installations among the Byllesby companies, illustrated by a number of lantern slides of motor drives, lighting, etc. Mr. Miller F. Moore, the general manager of the first Edison company, was introduced by Mr. Byllesby, once his employee, and gave some interesting reminiscences.

"They Only Rise to Command Who Have Learned to Obey" was the text of an address by Gen. George H. Harries, of Louisville, Ky., in which he spoke of the necessity of discipline to the fullest development of the organization and the individual. General Harries counseled balance in mind as in temper under all circumstances, and reminded his auditors that the position of command is frequently one of anxiety.

After luncheon Mr. Otto E. Osthoff, vice-president and chief engineer of Messrs. H. M. Byllesby & Company, gave an illustrated talk on the properties of the company, which now include forty-two groups, serving 192 municipalities in eighteen states in all parts of the country.

Mr. W. F. Raber, of Pueblo, Col., was unanimously elected as chairman for the 1913 convention, and presided during the remainder of the present meeting. He appointed Mr. F. W. Insull, also of Pueblo, to act as secretary for the convention, succeeding Mr. R. E. Flower, of Mobile, Ala., who acted in that capacity with the former chairman, Mr. Jackson.

"The Attitude of the Manager Toward His New-Business Department" was the title of a paper read on Friday morning by Mr. Alex. F. Douglas, of Portland, Ore. Himself a new-business man, Mr. Douglas emphasized the importance of campaign work by the contract department, with which the local manager, he said, should keep the closest touch. Monthly meetings will enable all parties to co-operate to better advantage. The new-business department, declared the speaker, should be provided with attractive offices and surroundings, as well as technical publications from which to obtain installation data and sales suggestions. Plant and load conditions should be explained to the business getters that they may concentrate their efforts on the most desirable business. Messrs. J. W. Gillette, N. C. Draper, R. M. Jennings, H. L. Jackman and F. H. Tidnam took part in the discussion.

Mr. R. J. Graf followed with an account of the work of the Byllesby Investment Club for employees. Mr. T. C. Martin, secretary of the National Electric Light Association, spoke of the plans and accomplishments of the central-station men's organization, which now numbers 10,200 members. In the afternoon Mr. Thompson, of Orange, N. J., explained the construction and performance of the Edison nickel-iron storage battery in vehicle and truck use, aided by lantern-slide and moving-picture illustrations.

Mr. C. A. Coffin, president of the General Electric Company, spoke briefly, and was followed by Messrs. E. W. Rice, Jr., and J. R. Lovejoy, of the same company. The appearance at this time of Mr. Thomas A. Edison in the hall, accompanied by Mr. Samuel Insull, brought the convention to its feet with prolonged applause. Mr. Insull acknowledged the homage for Mr. Edison. Gen. G. H. Harries spoke later, as did also Messrs. A. S. Huey and J. H. Hughes, of the Byllesby company.

A feature of the convention was the noon luncheons served in the session room. Music and singing enlivened the lunch hours, and various prominent men present, both within and outside the Byllesby organization, were called to their feet for brief speeches. On the evening of Jan. 3 there was a reception at the home of Mr. and Mrs. H. M. Byllesby, 4358 Drexel Avenue, Chicago, for those attending the convention, and the grand finale of the enthusiastic gathering was a brilliant banquet, reported elsewhere in this issue, given in the Gold Room of the Congress Hotel.

Massachusetts Legislative News.

The Massachusetts Legislature of 1912, which convened at Boston on Jan. 3, will deal with a number of matters of electric-railway interest, and the disposition of the surplus of gas and electric-light companies will be considered, among other matters carried over from last year. It is probable that another attempt will be made to secure the passage of a law providing for the electrification of the steam railroads within the Boston suburban district. Important measures also pending are the authorization of the control of the street-railway systems of the western portion of the State by the New York, New Haven & Hartford Railroad and the construction of a tunnel for electrical train operation either under Boston Harbor or under the city proper between the North and South Stations.

PUBLIC SERVICE COMMISSION NEWS.

NEW YORK COMMISSION.

Within a few days of the first of the year a number of corporations have applied to the Public Service Commission, Second District, for authority to issue securities with the proceeds of which to reimburse their treasuries for money expended for fixed amounts from net income in the past. The total of the applications in this class filed during the last week was $19,205,345.26. These expenditures from income in some cases extend back into the eighties, and the cause of the large influx of such applications at this time is that since Jan. 1, 1912, securities may be authorized by the commission to reimburse the treasuries of corporations subject to the stock and bond provisions of the public service commissions law only for the five years next preceding the date of the application.

This provision of the law was inserted by an amendment passed by the Legislature of 1910. Prior to that time the commission was permitted to authorize securities for only four purposes, namely, (1) acquisition of property; (2) construction, completion and extension or improvement of facilities; (3) improvement or maintenance of service; (4) discharge or lawful refunding of obligations. This meant that if a corporation invested its surplus earnings over fixed charges in fixed assets it could not later reimburse its treasury on account of such expenditures, and as a result the managers of many corporations were impelled, not knowing what the future would bring forth, to capitalize by the issuance of stocks and bonds every dollar expended on their properties, even though they did not believe such a practice to be in accord with a conservative financial policy.

To do away with this necessity the law was amended in 1910, and up to the first of the year corporations might have included in their applications expenditures from income as far back as they saw fit, and from now on may ask to be reimbursed for expenditures during the preceding five years. As to the applications covering a period prior to 1907 it is left to the discretion of the commission whether its consent shall be granted.

During the year just closed the commission authorized securities for the corporations under its jurisdiction amounting to $162,581,718.52, as follows: Steam railroads, $119,718,937.52; electric railways, $24,323,500; gas and electric corporations, $17,952,581; telephone corporations, $581,700. The total amount authorized during the four and one-half years of the commission's existence is $566,469,507.86.

The hearing on the complaint of several organizations of engineers operating isolated plants in New York City alleging that discriminatory rates are given by the New York Edison Company to large users of energy was continued on Thursday afternoon, Jan. 4, before Commissioner Maltbie, of the Commission for the First District. The greater part of the hearing was taken up with the endeavors of counsel for the complainants to obtain permission to read verbatim extracts from a large number of the standard rider and contract forms into the record of the proceedings after he had already offered these forms as a whole by name as exhibits in the case and they had been marked as such and noted upon the record. His object in doing this, counsel said, was to present his case in an analytical way. He believed it pertinent, therefore, to review the various forms under which the company does business before the commission and those connected with the case, and wished the extracts read into the record for subsequent reference in the case. After prolonged discussion the commission ruled that it was unnecessary and a waste of time to encumber the record with voluminous data already on file at the offices of the commission, to which all persons had access, and that such portions of the exhibits as counsel desired to cite for refreshing the memories of witnesses might be cited, but would not be read into the record.

When this ruling had been given counsel for the complainants examined the treasurer of the New York Edison Company upon the several light and power contracts between his company and various of its customers from whom is leases space on the premises served for substation purposes. Counsel for the company objected to introduction of these forms and the general procedure on the ground of irrelevancy, particularly in the case of examination into contracts for supplying light, power and steam to the new General Post Office, contending that contracts between the company and the government were not within the jurisdiction of the commission and had no bearing on the present issue.

With an intent to show that the company was strongly opposed to competition in any form, counsel for the complainants called counsel for the Edison company and questioned him upon his connection with a number of cases in which as counsel for that company he had opposed the granting of franchises to other companies in the city. Aside from a statement that he would not disclose relations between himself and any client and a pithy denunciation of the motives of the complainants in filing the complaint, nothing of moment was obtained from the witness. The auditor of the company was examined upon the meaning of parts of several annual reports of the company, and the hearing adjourned until Thursday, Jan. 11, at 2:30 p. m.

The New York Public Service Commission, Second District, has rendered a decision authorizing the issue of securities for the construction of the line of the Hudson River & Eastern Traction Company from Ossining to White Plains, a distance of 16 miles. The representatives of the company declared that the construction of the road was dependent wholly upon the issue of bonds for the amounts needed, and that stock would not be subscribed for the enterprise. The commission, in authorizing the construction to proceed in accordance with this representation, states that it faced the alternative of preventing the construction or permitting the company to build upon bonds. It cannot prove that the returns will not be as great as those claimed by the company. The commission still adheres to the opinion that capitalization should be divided between stock and bonds, and that bonds should not be permitted beyond an amount on which the enterprise will be practically certain to be able to pay interest. The total amount of bonds which the company asked permission to issue was $850,000, and it was expected to realize 80 per cent, or $680,000, on these. The commission finally allowed a bond issue of $806,000. It was unwilling to allow securities to be issued for a deficit arising from the operation of a portion of the line. It was also unwilling to authorize the issue of $50,000 stock to Mr. F. A. Stratton in settlement of claims for promotion and procuring franchises and rights-of-way. The commission believes that Mr. Stratton is entitled to something for services rendered. The commission definitely disavows any responsibility to the purchasers of bonds as to the earning power of the road or the probability, or possibility even, of the road paying fixed charges.

MASSACHUSETTS COMMISSION.

The Gas and Electric Light Commission has issued an order approving the application of the Salem Electric Lighting Company for authority to issue 5000 shares of new capital stock of the par value of $250,000, the proceeds to be applied to the cost of plant additions. The notes of the company on June 30 last amounted to $255,000, and the board finds that all of these appear to have been issued on account of additions to plant, except $27,500 borrowed to enable the company to pay an extra dividend just before the control of the corporation was acquired by the present owners. Coupon notes for $50,000 which were issued in 1901 to meet a part of the cost of plant additions previously made and which were outstanding at the time of the hearing and have since matured are included in the

ordinary promissory notes of the company as above stated; so also are the cost of additional land purchased during the fiscal year 1910, amounting to $30,000, and an expenditure of nearly $50,000 for underground conduits. The plans of the company contemplate an additional expenditure for underground work amounting to about $175,000. The board approves the issue of 4400 shares at the price of $90 per share as determined by the directors, the par value being $50.

The Gas and Electric Light Commission has issued an order approving the application of the Worcester Suburban Electric Company for authority to issue new capital stock of the par value of $125,000. The board approves the price fixed by the directors, $100 per share. It appeared at the hearing on this petition that the company had outstanding promissory notes to the amount of $200,000 and also accounts payable for about $31,000, a portion of which was on account of additions to the plant. It also appeared that between June, 1910, and September, 1911, $152,000 had been expended on account of the plant. On Nov. 30 last the company's notes had increased to $230,000. Some question developed at the hearing as to whether certain items of the above expenditures were properly capitalizable. In view, however, of an evident expenditure for new plant equivalent to the par value of the amount of stock named in the petition, the board deems it advisable to approve at this time an issue of new stock to that amount, reserving without prejudice the questions raised to be considered whenever the board may be asked to pass upon the question of a further issue of stock. The proceeds of the issue are to be applied to the cancellation of an equal amount of the obligations of the company represented by its promissory notes outstanding on Sept. 30, 1911, and to no other purpose.

The Highway Commission, which has supervision over telephone and telegraph companies, has taken up the question of pole-line and wire installation on the public thoroughfares with several of the largest public-utility companies, to secure suggestions as to what would be the best method of location and construction, and it intends in the near future to attempt to draw some standard specifications which will be applicable to all highways and to all pole and wire locations thereon, to secure additional protection to signaling circuits from lines carrying current at high voltage.

WISCONSIN COMMISSION.

The commission has authorized the Wausau Street Railway Company to issue $350,000 par value of bonds, to bear interest at the rate of 5 per cent per annum, payable semi-annually on the first days of January and July, and to be secured by a mortgage or trust deed issued to the Wisconsin Valley Trust Company, of Wausau. The certificate stipulates that the bonds are to be issued in exchange for the outstanding bonds of the company and in payment of an amount due on a certain water-power contract; to provide the company with funds to pay outstanding bonds not exchanged and outstanding notes and accounts due, such indebtedness having been incurred by reason of extensions and additions made to the property and for purposes properly chargeable to its capital account; for stock of the Wisconsin Valley Improvement Company; for the construction of a steam auxiliary power plant and transmission line; for street-railway extensions; for development of water-power and additions to the water-power plant; for extensions and additions to its electric light and power system. All proposed expenditures were duly investigated by the commission and were found to be for proper and lawful purposes.

Preliminary testimony has been taken in the matter of the application of Frank Winter, of La Crosse, for the physical connection of the La Crosse Telephone Company and the Bell Telephone Company. The case arose in connection with the law passed by the last Legislature providing for the physical connection of telephone systems, and it is the intention of the Bell Telephone Company to test the law and the commission's jurisdiction in the matter before complying with the law in the present case or in the many other cases where physical connection with the Bell system has been requested. The hearing is to be continued.

The Mineral Point Public Service Company has been authorized to issue $23,000 par value of stock and $42,000 par value of 5 per cent bonds, the latter to be secured by a mortgage issued to the First Savings & Trust Company, of Milwaukee. The stock and bonds are to be issued and exchanged for all property and equipment used in connection with and as a part of the electric and steam-heating departments of the Mineral Point Electric Light Company. The Mineral Point Public Service Company has also been authorized to issue $127,000 par value of stock and $75,000 par value of 5 per cent bonds. The latter are to be dated Feb. 1, 1912, to mature Feb. 1, 1932, and the interest is to be payable semi-annually on the first days of February and August. This issue of stock and bonds was authorized for the purpose of supplying the company with funds for acquiring the necessary real estate and reconstructing the plant of the Mineral Point Electric Light Company, and for purchasing and installing the necessary equipment and for erecting transmission lines.

The commission has canceled the certificate issued to the Berlin Public Service Company under date of Nov. 28, 1911, authorizing the issue of $70,000 par value of bonds and has authorized in its place an issue of $59,500 par value of 5 per cent bonds to be secured by a mortgage issued to the Fidelity Trust Company, of Milwaukee, and two promissory notes for the total sum of $10,500, payable to the Berlin Gas Company. The foregoing are to be exchanged for the property and effects belonging to the Berlin Gas Company.

NEW JERSEY COMMISSION.

A decision has been rendered in a case affecting the Woolwich Water Company, in which the Board of Public Utility Commissioners of New Jersey says that, unless by explicit and clearly demonstrable contract or agreement the company's right to super-add an annual meter rent to a fixed minimum or maximum rate or charge can be shown, the board, as a matter of public policy and with the intent of minimizing possible points of controversy between water companies and their patrons, will deny such right.

The Board of Public Utility Commissioners of New Jersey has rendered a decision in a case affecting the New Jersey & Hudson River Railway & Ferry Company and the Public Service Railway. An abstract of the decision setting forth the principles involved says that, where no undue discrimination is alleged, a reduction of fare requested by a single community cannot be ordered without consideration of how similar reductions on the line of the carrier concerned would affect the total net revenue. The eventual system of trolley charges must be a uniform basic charge, as with certain other public utilities, plus a variable charge graduated roughly by the distance traversed.

The Board of Public Utility Commissioners of New Jersey has submitted its annual report to Governor Woodrow Wilson. Doubts which were entertained previously as to the powers of the board under the law of 1910 were largely removed by the act of 1911. It is pre-eminently the extension of the power of the board over rates that differentiated most notably the last eight months of the board's experience over preceding periods, and it is owing to the existence of this rate-making power that state control of public utilities in New Jersey has assumed its present complexion. At the present time the three most far-reaching problems that face the commission are rooted in matters of control of rates for public utility service. These three problems involve, first, rates for intrastate commutation service;

second, the price of gas, and, third, charges for telephone service in a considerable area of the State.

The board has received a number of complaints from municipalities alleging unreasonable charges for gas. The first complaint came from Paterson, and the board deemed it wise to investigate thoroughly in connection with this complaint conditions in the Passaic district before taking up other complaints. In doing this the board has caused a valuation to be made of the properties of the Public Service Gas Company in the Passaic district, employing for this purpose an expert firm of gas engineers with special knowledge of the value of gas properties. This valuation has been practically completed, and hearings are now being conducted at which further information is being obtained that, taken in connection with the work of the board's experts, will form a basis for final decision.

All of the gas companies, as well as other utilities, have been requested to file schedules of rates with the board, and a study of these has caused the board to initiate on its motion inquiries into the reasonableness of the charges made by several companies.

A number of complaints have been made to the board in regard to the system of minimum charges made for electric service provided by the company which supplies the larger municipalities and many of the smaller places as well. The determination of an equitable basis for minimum charges and the times of payment therefor is an intricate problem which is being investigated thoroughly by the board and upon which its conclusions will be announced at an early date. Inquiries have also been initiated by the board as to the reasonableness of regular charges for electric service, and these are being conducted as expeditiously as possible with the means at the board's command. Without attempting to forecast the outcome of such investigation, it is stated that rates for electric energy for light and power appear to be more nearly conformable to the rates exacted for similar service elsewhere in comparable instances.

As a result of the filing of schedules of telephone companies there has been a very considerable reduction of non-standard and discriminatory rates.

The board has issued an order establishing a system of standards and regulations to be observed by the gas companies.

The board's electrical inspector was directed to investigate the complaints of the electric-lighting companies, to make general inspections of the plants and their overhead systems and to give special attention to the subject of consumers' meters and methods and apparatus used to maintain their accuracy. With the exception of a few plants which will be inspected at an early date, this work has now been done. During these inspections the standards in use were examined and the methods of testing and of keeping records were investigated. A majority of the companies were found to be equipped with suitable apparatus for testing, but had no means of checking their own standards. This is properly a function of the board, to provide for which, by the courtesy of the trustees of Rutgers College, it has equipped an electrical laboratory in one of the college buildings.

There is at the laboratory a Westinghouse precision wattmeter, tested and certified by the National Bureau of Standards, Washington, and carried back from there by the inspector of the board. In addition to this the equipment comprises a General Electric 60-cycle rotating standard, a Westinghouse 133-cycle rotating standard, a General Electric ammeter, two alternating-current and direct-current voltmeters and an indicating wattmeter with a current transformer. For direct current, of which there is comparatively little in the State, the commission has a Weston voltmeter, a milli-voltmeter with triple range shunt and two General Electric direct-current rotating standards. There is also a potential battery giving anything up to 500 volts and two current batteries.

Progress was made during the year in the work of the uniform system of accounts. The statutory power conferred on the board of fixing rates of depreciation can be exercised safely only upon the basis of a scientific system of accounting.

The requirement that the board shall approve the purpose of the issue of securities has been construed by the board as intended to afford it legitimate amplitude in inquiry into the end sought by the proposed security issues. While the board does not believe that any fair and legitimate issue of securities has been denied, impeded or unnecessarily delayed by such a construction of the statute, it is true that the board not infrequently has insisted on a reduction of proposed issues where the physical assets or earning powers of properties seemed to warrant such reduction. The board conceives that its function is to authorize no bond issue where there is not a strong likelihood that fixed charges can be earned regularly and the principal paid at maturity.

A number of amendments to the law are suggested. First, it is the opinion of the board that public utilities which issue bonds hereafter for cash or property of a less amount or value than the face value of the bonds shall be required to provide out of their earnings for the amortization of the discount at which such bonds have been issued or sold; and the rate at which such provision for amortization shall be made shall be determined by the board. Second, the powers conferred upon the board to direct any railroad or street railway to establish just and reasonable connection should be extended to other utilities where possible. Third, an indeterminate franchise should be established by law, compulsory for all new public utilities, and permissive where possible under existing laws, or by mutual arrangement for existing public utilities, provided that the form of the grant or permit shall be indeterminate so long as the operation of the utility conforms to the law of the State and the lawfully issued orders of this board, or until purchased by a municipality; that the corporate property, exclusive of franchise valuations, and with all intangible values defined by law in advance, shall be entitled to a fair return while operated by the company or its successors and shall be purchasable at a fair price if ever taken over by the municipality.

During the year the board has maintained two divisions of its force, the railroad division and the utilities division, each division comprising a chief and three assistant inspectors. The inspectors in the utilities division have been selected with special reference to their education and experience in electrical, mechanical or civil engineering.

Current News and Notes.

New York Sons of Jove Rejuvenation.—A rejuvenation of the Sons of Jove will be held at the Hotel Astor Feb. 7, to be preceded by a dinner. The Belvidere room will be used for the occasion.

* * *

Minnesota Electrical Association.—The next meeting of the Minnesota Electrical Association will be held March 20-22 at Minneapolis, Minn. The Northwestern Electrical Show will be held coincidently.

* * *

Deadwood (S. D.) N. E. L. A. Company Section.—The employees of the Consolidated Power & Light Company of South Dakota have formed a company section of the National Electric Light Association known as the Consolidated Power & Light Company Section, with headquarters at Deadwood, and including employees of the company in Deadwood, Lead and Spearfish. The company has given the use of a building as a club for library, reading-rooms and meeting place.

DE ROMAS AND THE LIGHTNING KITE.—In the article on "De Romas and the Lightning Kite" which appeared in the issue of Dec. 30 it is stated (page 1588) that pistol-shot flashes were obtained "reported to be 9 ft. long and 3 ft. thick." The last three words should have read "1 in. thick.

* * *

DINNER REUNION OF CORNELL ELECTRICAL ENGINEERS.—Preceding each meeting of the American Institute of Electrical Engineers in New York the alumni of Cornell University who attend the meeting assemble for dinner at the Cornell University Club, which has extended the privileges of its house to non-member Cornell alumni for this purpose.

* * *

WIRELESS TRANSMISSION WITHOUT MASTS.—According to reports from Rome, Italy, Mr. William Marconi has discovered that wireless messages can be sent over desert land without the usual masts. Sand, being a non-conductor, acts as insulation for the wires which are laid on the ground in the direction in which the message is to be sent. Stations without masts can easily be established and maintained without becoming conspicuous to the enemy in time of war.

* * *

COLORADO ELECTRIC CLUB.—The first annual ball of the Colorado Electric Club was held on Friday night, Dec. 29, in the banquet hall of the Brown Palace Hotel, Denver, with over 200 members and their partners present. Refreshments were served, card tables were provided for the bridge players, and there was a Christmas tree from which a souvenir was presented to each person present. Mr. Clare N. Stannard, secretary of the Denver Gas & Electric Light Company, was chairman of the entertainment committee.

* * *

INVESTMENT AND INCOME OF THE CENTRAL-STATION INDUSTRY.—Messrs. C. A. Coffin and T. C. Martin are authority for the estimate that the present total investment in the central-station industry of this country aggregates $2,500,000,000. The total earnings of the industry during the year just closed are similarly estimated at $400,000,000, based on data in the hands of the authorities quoted. Mr. Martin in an address before the recent Byllesby convention in Chicago declared that 10,000 young men enter the central-station industry each year.

* * *

BOSTON EDISON N. E. L. A. SECTION MEETING.—The next regular meeting of the Boston Edison Company Section of the N. E. L. A. will be held in the auditorium of the Edison Building, 39 Boylston Street, Boston, at 7:45 p. m. Jan. 16. The subjects to be presented will be "Handling of Complaints in a Large Electric Light Company," by Mr. E. C. Kimball, of the Boston Edison Company, and "The Recent Power Developments of the Boston Elevated Railway Company," by Messrs. C. W. E. Clark and E. N. Lake, of the Stone & Webster Engineering Corporation, Boston, Mass.

* * *

THE ARMY AND NAVY AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY.—Following the custom of recent years the United States government has sent officers of the army and navy to the Institute to receive instruction in electrical engineering, these being in addition to the graduates of the Naval Academy who are sent to take a course in naval architecture. This year the Naval Academy is represented by Ensign G. K. Calhoun, who was graduated from Annapolis in 1908. He has recently been stationed at the United States Naval Observatory at Washington, where he has done considerable work in wireless telegraphy, ship propulsion, gyroscopic compasses and chronometers. The army is represented by Capt. Edward Canfield, West Point, 1901, and First Lieut. F. Q. C. Gardner, West Point, 1904. Both officers have been connected with the Coast Artillery Corps, Captain Canfield being stationed at Puget Sound and Lieutenant Gardner at Fortress Monroe. Both men will pursue a special course in electrical engineering.

* * *

PUBLIC-UTILITY REGULATION EXPOUNDED BY NEWSPAPER ADVERTISING.—In the *Chicago Record-Herald* of Jan. 1 appeared a full-page advertisement under the title "The Meaning of Public-Utility Regulation," and signed by Mr. Theo. Van R. Ashcroft, making a temperate and well-considered plea for a public service commission law in the State of Illinois. By statute the rates for public utilities in Chicago are fixed now by the Mayor and City Council. The City Council is made up of seventy aldermen. Its membership changes every year to some extent, and is made up of men of widely varying occupations. Mr. Ashcroft contends that public-service regulation should be removed from every influence savoring of politics. One strong paragraph from his argument is as follows: "There is no solution of this subject unless there be enacted in every state a comprehensive code of legislation dealing with the subject of the taxation of values, the allowing of values for rate purposes, uniform accounting and publicity of accounts, and giving to some established body the authority of enforcing its rules and regulations."

* * *

COMMONWEALTH EDISON SECTION, N. E. L. A.—Mr. L. C. Fritch, chief engineer of the Chicago Great Western Railroad, was the speaker at the general meeting of the Commonwealth Edison Company Section of the National Electric Light Association in Association Hall, Chicago, on the evening of Jan. 3. His subject was "Chicago Railway Terminals," and he showed how the city had outgrown its railroad facilities and how the entire method of handling local and through railroad freight in Chicago could be changed to advantage. Incidental reference was made to the advantage of electrifying passenger service within an inner zone. The N. E. L. A. orchestra gave some excellent music and there were selections by a glee club and a very amusing performance by a burlesque German band. On motion of Mr. H. L. Gannett, a resolution expressing the section's cordial appreciation of the action of the president and directors of the Commonwealth Edison Company in establishing a service-annuity system was adopted with enthusiasm. Mr. R. F. Schuchardt, chairman of the section, presided, and by vote it was decided to present to him a section button badge in gold. The attendance was about 600.

* * *

CO-OPERATIVE ELECTRICAL ADVERTISING.—In a recent issue of a Cleveland newspaper forty-one local competitors in the electrical field were represented in an "electrical page," consisting partly of reading matter. Starting three years ago in one paper in Cleveland, the electrical page now appears each week in the three leading daily newspapers, having a certified circulation of 205,000. This plan already has commended itself to electrical men in Pittsburgh, Milwaukee, Youngstown, Dayton, Washington, Boston, Louisville, New Orleans and Minneapolis, where the different electrical interests are similarly co-operating and expending $2,153 per week in popularizing electrical service through exclusively electrical pages in papers with a certified circulation of 916,000. Moreover, Chicago, Buffalo, Denver, San Francisco and Seattle are said to be about to inaugurate the plan. The idea of the electrical page originated with Mr. J. Robert Crouse, and great credit is due to Mr. M. E. Turner, of the Cleveland Electric Illuminating Company, and to Mr. Philip Dodd, of the National Electric Lamp Association, for doing the pioneer work in this new and improved method of advertising and education, as well as to the Electrical League of Cleveland and similar organizations in other cities, which have toned down the asperities of local business rivalry to a point where the joint cultivation of the market is seen to be a common gain, most effectively realized through co-operation.

WIRELESS TELEGRAPH MEETING.—The Society of Wireless Telegraph Engineers will hold a meeting on Jan. 15, 1912, at 8:30 p. m., in the Engineering Societies Building, New York City. A paper entitled "Capacities" will be read by Mr. F. Lowenstein. The meeting will be open to all who wish to attend.

* * *

ELECTRIFICATION OF SWEDISH RAILWAYS.—It is stated that the electrification and double tracking of the railway from Gothenburg to Alingsas, on the main line between Gothenburg and Stockholm, will be completed by May, 1914. If found successful in operation the availability of large water-powers and the complete lack of coal suitable for railway purposes will likely lead to further electrification of this line.

* * *

AN ELECTRICAL FAKE.—A man has recently been making the rounds of Southern Indiana reaping a good harvest by selling an attachment to electric-light circuits which, he has represented, will give a saving of 25 per cent on light bills when installed between the meter and the lights. He collects $15 in advance. His so-called machine is an ordinary 4-in.-deep outlet or junction box with two wires passing straight through, the box being filled with ordinary cement.

* * *

PROPOSED ELECTRIFICATION OF THE ST. GOTTHARD TUNNEL ROUTE.—Dr. Tissot, a Swiss authority on the electric railway, has recently reported the results of his study as to the feasibility of electrifying the railway through the St. Gotthard tunnel. His report shows that the transportation of 1 metric ton (2,204.6 lb.) of merchandise, which now costs by steam 0.94 centime (0.18 cent) per kilometer (0.62 mile), would be reduced to 0.7 centime (0.13 cent) per kilometer. The calculation was made on a basis of an annual traffic of 1,437,000,000 kilometric tons.

* * *

MEETING OF BOILER MANUFACTURERS.—The twenty-fourth annual convention of the American Boiler Manufacturers' Association, and of its associate, the Supplymen's Association, will be held in New Orleans, La., March 12-15. A number of papers will be presented at the meeting, and an extensive program of entertainment has been arranged. A large attendance of boiler manufacturers and supplymen from the United States and Canada is expected. Mr. F. B. Slocum, Continental Iron Works, Brooklyn, N. Y., is secretary of the Supplymen's Association of the American Boiler Manufacturers' Association.

* * *

PRIME MOVERS N. E. L. A. COMMITTEE.—A meeting of the National Electric Light Association's committee on prime movers was held in Chicago on Jan. 3 and 4. There were present Mr. I. E. Moultrop, of Boston, chairman, and Messrs. W. L. Abbott, of Chicago; F. N. Bushnell, of Boston; E. D. Dreyfus, of Pittsburgh; John Hunter, of St. Louis, and W. N. Ryerson, of Duluth. Inasmuch as the committee will report at the convention to be held in Seattle in June, in a region where hydroelectric development is of commanding importance, particular attention will be paid to water-wheels and other features of hydraulic-power stations.

* * *

AMERICAN MUSEUM OF SAFETY.—The annual exercises of the American Museum of Safety will be held in the Engineering Societies Building, New York, on Thursday evening, Jan. 18, during which there will be a presentation of medals, as follows: Travelers' Insurance Company's medal, to the Pennsylvania Railroad Company, for its policy in the protection of the lives and limbs of its employees; *Scientific American* gold medal, to the Norton Company, Worcester, Mass., for the most efficient safety device invented in the past three years. The Louis Livingston Seaman gold medal for promotion of hygiene and sanitation and mitigation of occupational disease will also be awarded.

* * *

NEW YORK JOVIAN LUNCHEON.—About 150 were present at the New York luncheon of the Sons of Jove on Wednesday, Jan. 10. The guest of honor on the occasion was Mr. Arthur Williams, of the New York Edison Company, whose subject was "The New Industrialism." Mr. Williams' talk was most interesting, treating as it did on the subject of co-operation between employer and employee. The speaker told of his observations in European countries and stated that where systematic co-operation existed between the employer and his employees it was usually accompanied with provision for full workmen's compensation, and that attention by the employer to the welfare of his men was fully rewarded by employees in better service and more thought for their employer's interest.

* * *

RATE RESEARCH COMMITTEE.—At the meeting of the rate research committee of the National Electric Light Association held in Cleveland on Jan. 4 and 5 there were present Chairman E. W. Lloyd and Committeemen L. H. Conklin, S. E. Doane, R. S. Hale, J. D. Lyon, R. A. Philip and W. H. Winslow, also Secretary W. J. Norton. The discussion was exhaustive and took a wide range. The members of the committee were themselves surprised at the arguments that could be presented both for and against almost any given system of rate making. A number of the member companies of the association have already designated some officer or employee to be the "company assistant" of the rate research committee, with the idea that inquiries in relation to rates could be handled more promptly and carefully if the subject were referred to some designated man in the company. At the next meeting of the committee, which will be held in Chicago on Feb. 7 and 8, it is hoped that the first rough draft of the committee's report will be ready for discussion.

* * *

CO-OPERATION IN ST. LOUIS.—Mr. A. C. Einstein, the new president of the Union Electric Light & Power Company, of St. Louis, was the guest of honor at the meeting of the St. Louis League of Electrical Interests on Jan. 2. Mr. H. H. Humphrey, president of the league, who is an old friend of Mr. Einstein, spoke of the latter's connection with the various electrical interests of St. Louis and also of his engineering work in Paducah, Ky., and other places. In response, Mr. Einstein said, among other things: "We will make it as easy as possible for the public to do business with us. Already we have moved the application desk downstairs, so that persons who want to apply for service will not need to take an elevator and hunt for that department. The lamp department has been put on the first floor also. These are but indications of the policy which we shall follow—that of consulting the patron's convenience and interest at every turn and of making it easy for him to do business with us." Mr. Einstein made an interesting reference to that portion of the business of his company outside the furnishing of electrical energy. In the past the Union Electric Light & Power Company has had to do considerable work in the wiring of buildings and has also had to handle electrical appliances. This work was taken up, not because the company desired it, but because it was necessary to provide a suitable market. The new president was emphatic in his declaration that it was his purpose to co-operate with the electrical interests of St. Louis. He has had experience in the supply business and he is in a position to appreciate thoroughly the consideration due the manufacturing and supply interests. The attendance at this meeting of the league was eighty-four, which is the largest since the noonday meetings were begun.

ELECTRICAL EQUIPMENT OF A GREAT GROUP OF OFFICE BUILDINGS

Electric Generating, Distributing, Motor and Illuminating Installations of the Buildings of the Prudential Insurance Company at Newark, N. J.

A Detailed Account of the Co-operative Consulting and Contracting Work Involved in Expanding an Installation to Take Care of Growth Not Anticipated When the Early Equipment Was Planned.

BY HENRY C. MEYER, JR., AND BASSETT JONES, JR.

IN THE half-basement of the State Bank Building, at the corner of Broad and Mechanic Streets, in Newark, N. J., was located the first home of the Prudential Friendly Society, which afterward became the Prudential Insurance Company of America. It occupied this building from 1875 to 1878. In 1878 the society moved to the first floor of the Centennial Building, at 215 Market Street, now the *Evening News* Building, where it remained until 1883. In 1883 the company moved to 878-880 Broad Street.

In 1890, as the company had outgrown its quarters, it was decided to erect a permanent home at the southwest corner of Broad and Bank Streets. Work was begun in this year, and the company moved during 1892. This building, then and now known as the Prudential Building, is a fine example of romanesque gothic designed by Messrs. George B. Post & Sons, which firm has also designed all the buildings constituting the present group.

By 1899 the company's business had increased so enormously that extra quarters had been rented in various loft and office buildings in the vicinity, and it became evident that if the work of this organization was to be carried on with proper economies further building operations were imperative. In that year, therefore, the foundations were laid for an imposing group of structures known as the Main Building and the West Building, on the south side of Bank Street, adjoining each other and the Prudential Building; also for the North Building, on the north side of Bank Street, and the Northwest Building, on the northwest corner of Bank and Halsey Streets.

These buildings were completed in 1900, and it then seemed that sufficient space had been provided to take care of any possible expansion for some time to come. However, the company's business continued to increase by leaps and bounds in a manner that it was quite impossible to anticipate, and in 1909 extra quarters had again been rented in nearby buildings. Work was then begun on the additions to the North Building, and this structure, with its additions recently completed, occupies nearly the entire block bounded by Broad, Bank, Halsey and Academy Streets.

At the same time that the additions to the North Building were designed other building operations were in contemplation which, it is presumed, will be carried out as fast as the demand for them justifies their construction.

A view of the entire group of buildings as it exists today is shown on this page, and the general arrangement of buildings is indicated in Fig. 3.

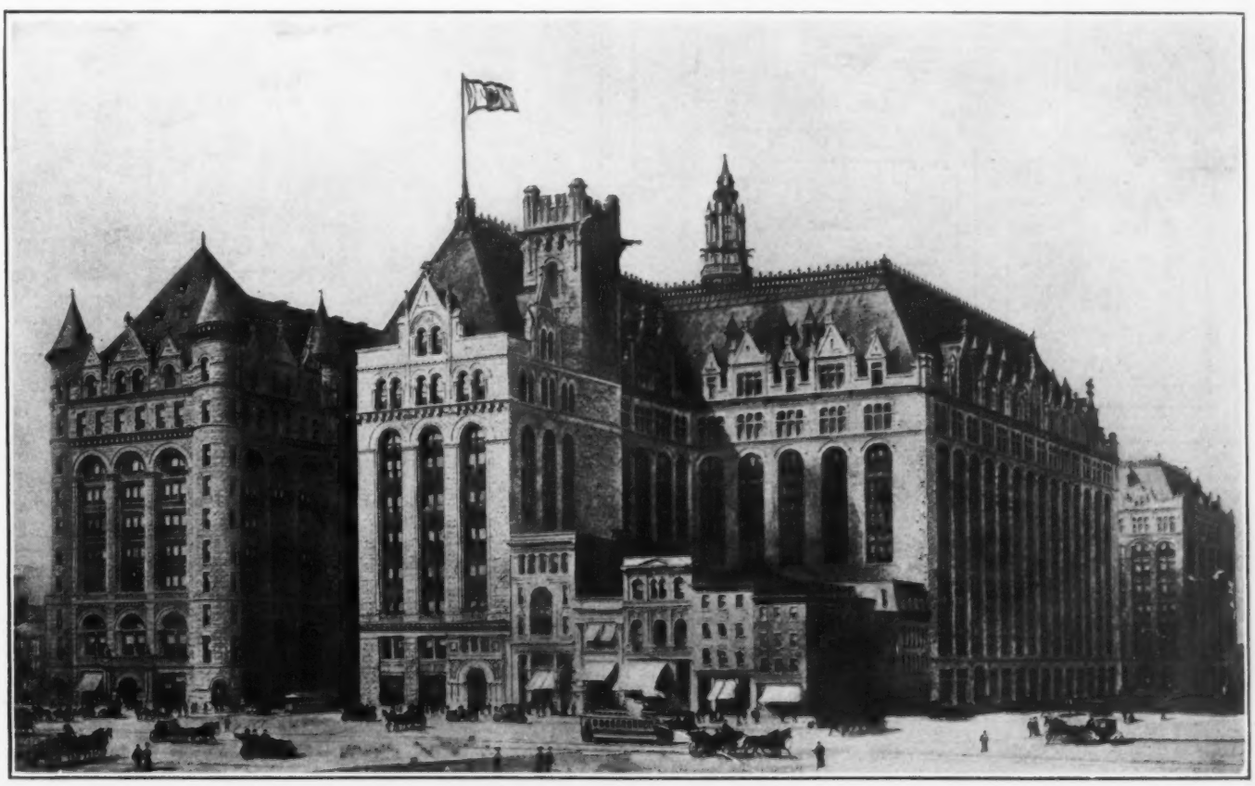
MAGNITUDE OF THE BUILDINGS.

Some idea of the magnitude of the structures may be gained from the statistics printed on page 93.

The total cubage of the entire group is 15,706,792 cu. ft. The buildings are approximately 180 ft. high to the ridge-pole. The North Building tower reaches to a height of 268 ft.

THE WORK OF TWENTY YEARS AGO.

It can well be imagined how varied would be the character of an electrical installation in buildings the construction of which was begun in 1890 and has continued from time to time through twenty years. When the Prudential Building was erected a small electric generating plant con-



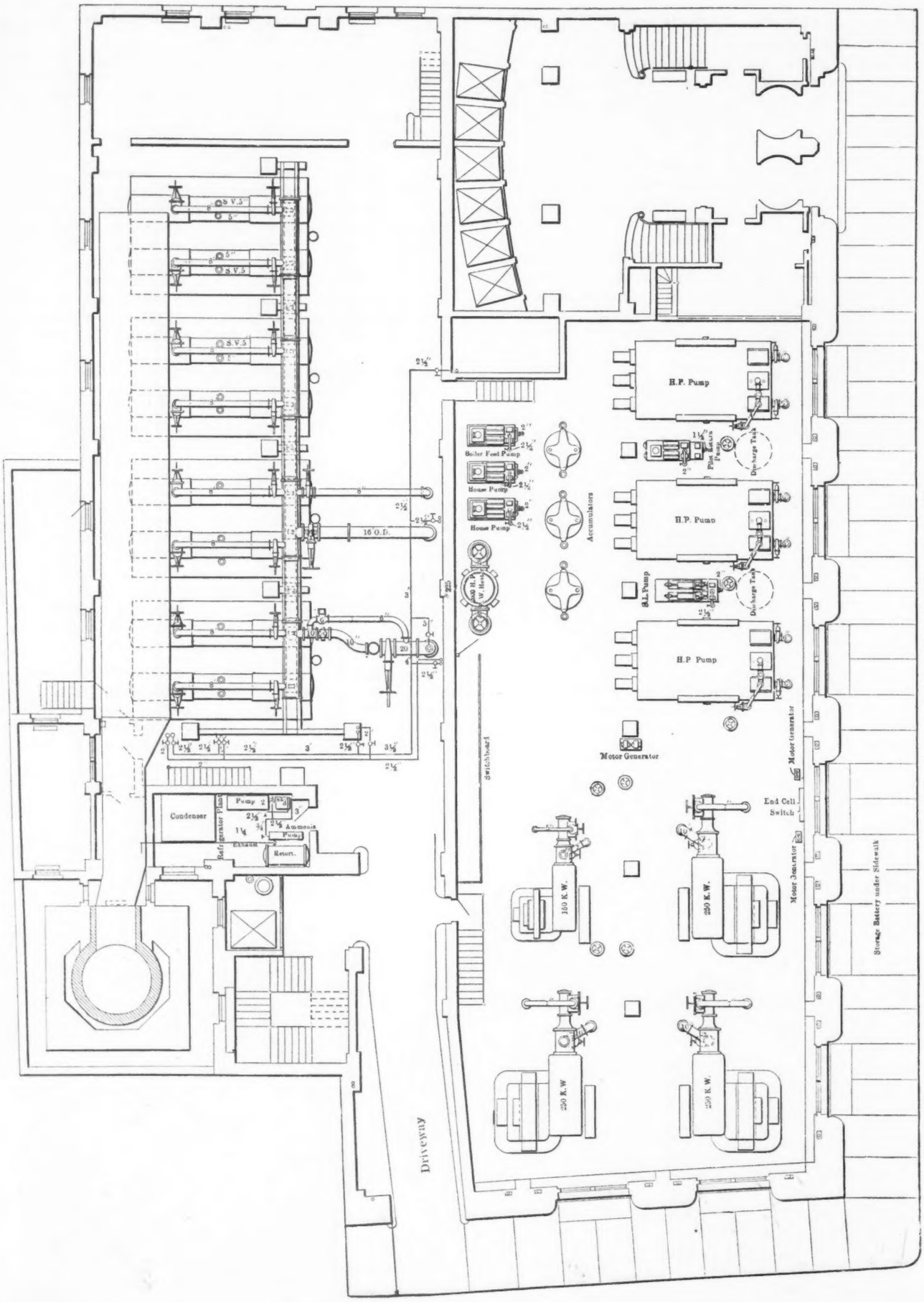


Fig. 2—Plan of Engine and Boiler Rooms in 1903.

sisting of a 45-kw, 110-volt generator belted to a Corliss engine was installed. Wires were run in brass-protected paper tubes, of which some have been in use up to the recent overhauling of the wiring in all the old buildings. In fact, this building was a most interesting museum of electric-wiring apparatus since many repairs and extensive alterations had been made from time to time in which materials and devices that were the best in use at the time of their installation had been used.

The electrical work done during the building operations

Building.	Floor Area, Square Feet.
Prudential	111,865
Main	87,735
West	46,901
Northwest	67,631
North	82,075
Academy Street	211,402
Bank and Broad Street	152,266
Total	759,875

of 1899-1902, which was installed by Messrs. Patterson Brothers as consulting engineers, was the most modern and best of its day and attracted much favorable comment. Practically the entire first floor and basement of the North Building were given over to a heating, lighting, elevator and auxiliary plant of large proportions (Fig. 3). Particular attention was given to the arrangement and finish of this equipment, as the entire engine-room was visible from the street. The generating equipment consisted of three 250-kw and one 150-kw, 120-volt direct-current generator of Bullock make, directly connected to Ball & Wood horizontal tandem-compound, four-valve engines. A storage battery was installed in connection with this plant.

Two-wire feeders for lighting were run from the main switchboard to sub-switchboards at the foot of the riser shafts in the several buildings, and a two-wire feeder for

Fig. 4—Main Building Old Floor Junction.

power was run to the press-room switchboard controlling the large printing establishment in the basement and first floor of the Northwest Building. Rising feeders extended from the sub-switchboards up the riser shafts to panelboards located on the various floors. The feeders to the buildings on the south side of Bank Street were run through a tunnel under the street to a subway system in the cellar of these buildings. This subway was provided with the necessary manholes and branch conduits to the sub-switchboard locations. This arrangement will be indicated in detail in a future issue.

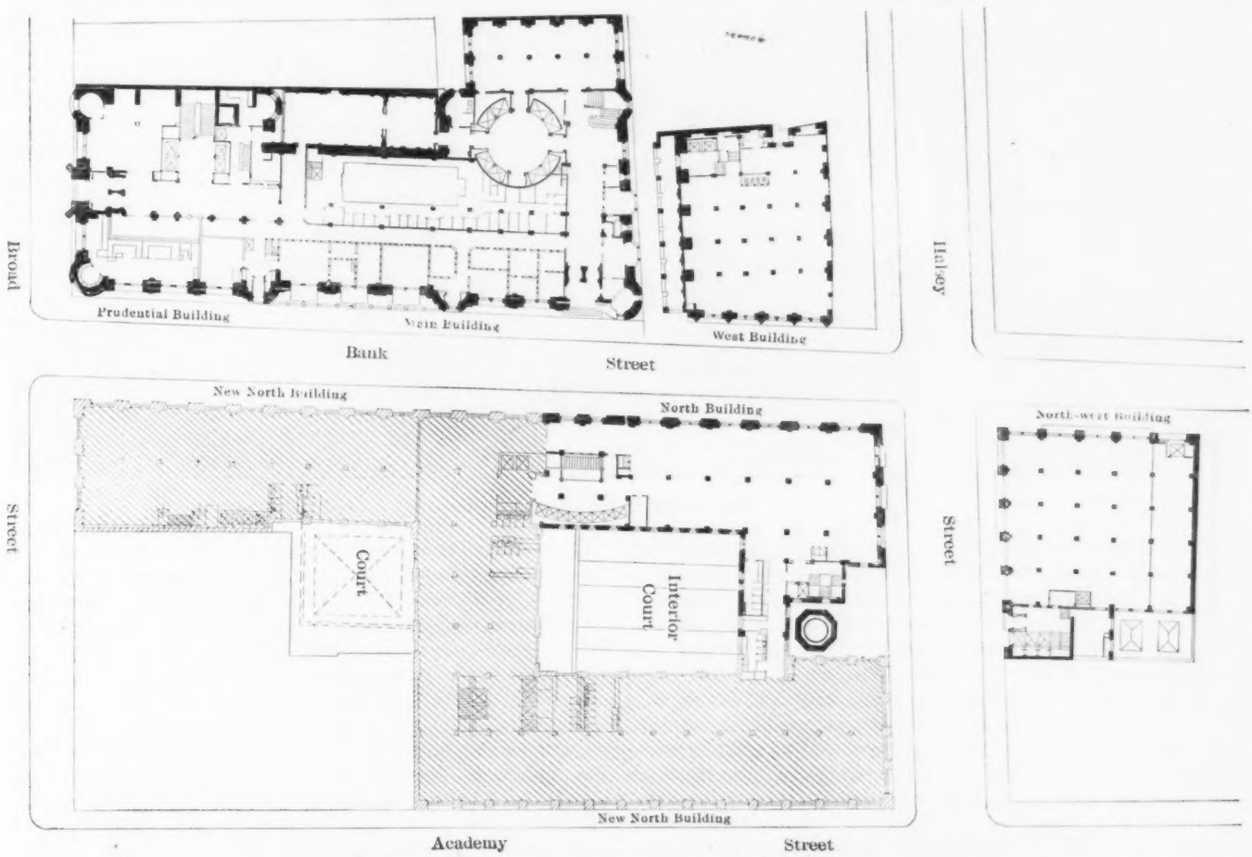


Fig. 3—General Plan of the Buildings of Prudential Insurance Company.

THE ORIGINAL INSTALLATION.

The initial receiver installation supplied by this equipment consisted of approximately 20,000 16-cp equivalents in lighting and upward of seventy motors the output of which varied from 1 hp to 50 hp. A full description of the plant can be found in the *American Electrican*, January, 1903.

The low-voltage equipment in these buildings, including telephones, annunciators, clocks, dismissal bells and auxiliary equipment of all kinds, was both elaborate and complete. The annunciator system had increased from a small beginning to probably the largest system of its kind in the world. Return calls and registering devices had been employed in all connections between buildings, and, in important cases, between desks on different floors in the same building. The annunciators on the desks of the different officials had become so large that lamp signals and combined lamp and push-button devices had been resorted to, with relays in the spaces behind the drawers especially arranged for in the desk construction. The annunciators of this class were as a general thing placed in one of the desk drawers.

As most desks were free standing, and as moving of individuals, departments and divisions was frequent, the difficulty of maintaining such a system can be readily imagined. Where the various departments were moved from one building to another, as was frequently required on account of the increase in business, it was necessary often to remove hundreds of annunciator and telephone connections, with the connections for lamps with which almost all of the desks are equipped, and in consequence great expense was incurred. These changes were still further complicated by the fact that the company's business had grown with such great rapidity that it was often necessary to send departments into a building or spaces originally intended for other purposes. Hence in 1909 the West Building, erected originally for filing, was principally used for clerical work. Furthermore, the growth of any single department would often demand the introduction of more furniture, with a consequent shifting of all the furniture already in use.

EFFICIENCY IN MAINTENANCE.

While every possible effort had been made to keep this enormous mass of wiring in efficient shape, by 1909 it had become an impossibility to maintain workmanlike conditions. In many cases two or three times as many wires ran to a junction point as the number for which it was possible to provide terminals. Indeed, wonder has been expressed how it was possible to keep the records so complete that the numerous changes could be made as expeditiously and as accurately as they were.

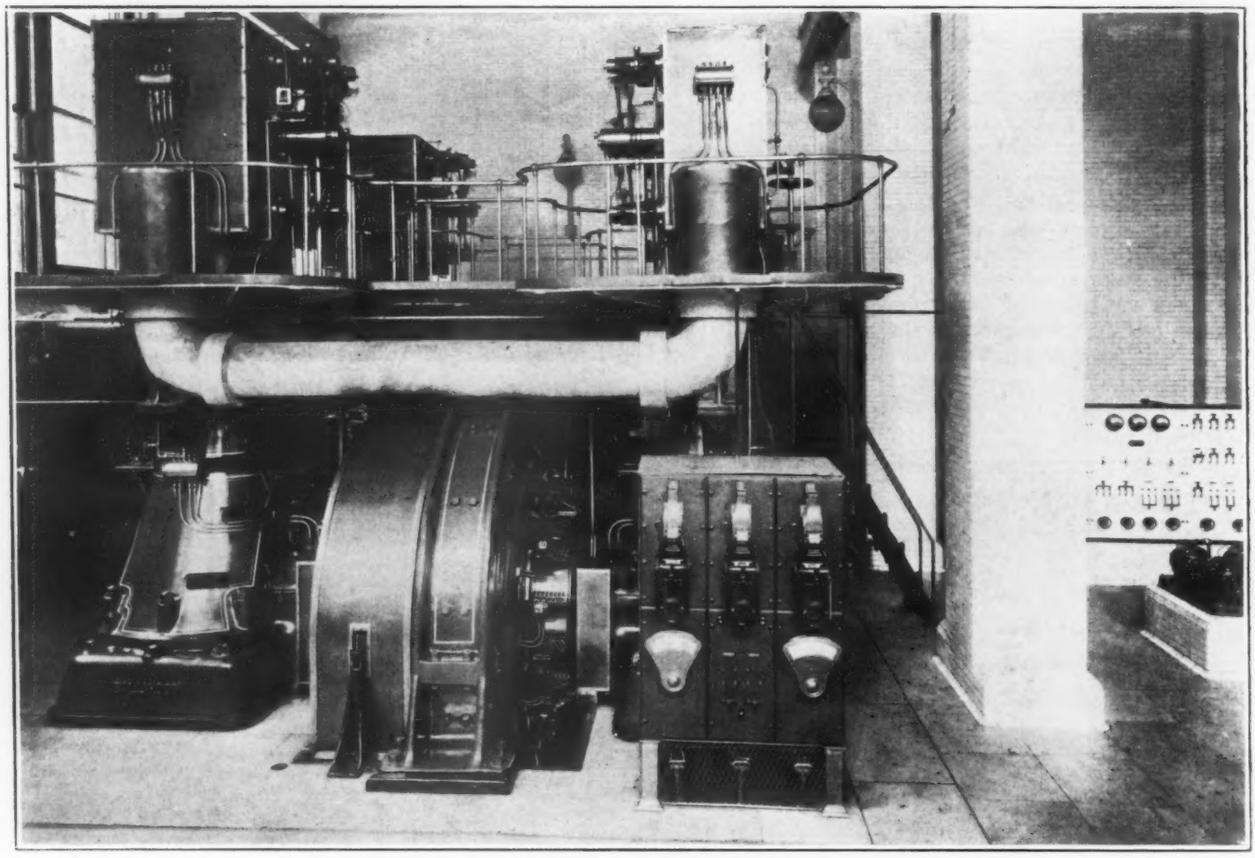


Fig. 5—New Engine Room.

The conduit system for the low-tension system had in many cases become almost as complicated as the wiring. Conduit extensions from furniture were in general run into floor boxes connected to main conduits run under the floors to the several distributing boxes which were in the basements. These junctions in the different buildings were connected together by trunk lines run in the subway system and through the tunnels under the streets.

In the older buildings on the south side of Bank Street the underfloor conduits had been laid as needed by the simple but often expensive expedient of taking up the floors or cutting slots through the flooring to the nearest point where connections could be made to existing conduits or floor boxes. In the North Building proper and in some parts of the Northwest Building a definite system of large interconnecting conduits had been installed with large floor boxes at the junctions connected to the distributing points at the riser shafts by "home-run" lines. Connections were made to the interconnecting lines by taking up the floor

over the proposed route to the piece of furniture to be connected, cutting into the line, inserting a blind floor box at this point and extending a branch line to the furniture box.

Generally speaking, similar arrangements were made for providing connections to desks for lamps, except that branch connections were usually run from the nearest floor box already in use.

INCREASING DEMANDS ON THE OLD PLANT.

Eventually the result of the continual moving of furniture was to fill the floors with dead conduits, lines and boxes. The covers of abandoned boxes were removed and wooden caps inserted flush with the finished floor. These changes, as stated above, often had to be made with such speed that time was not always available to pull in new lighting lines, and as the number of desks, etc., increased the circuits available were used to such an extent as to make further extensions dangerous. The wiring was mapped out before the revisions were undertaken with a view to finding how much of the old wiring could be used in the new work.

It should be noted, however, that the original installation would have been ample had it been possible to use the various floors for the purpose originally intended, and had not the growth of the company's business been so much greater than could have been anticipated. These general remarks are made to explain the conditions existing when work was begun on the North Building additions and to indicate the reasons for certain features of the new installation and of the remodeling of the old distributing system.

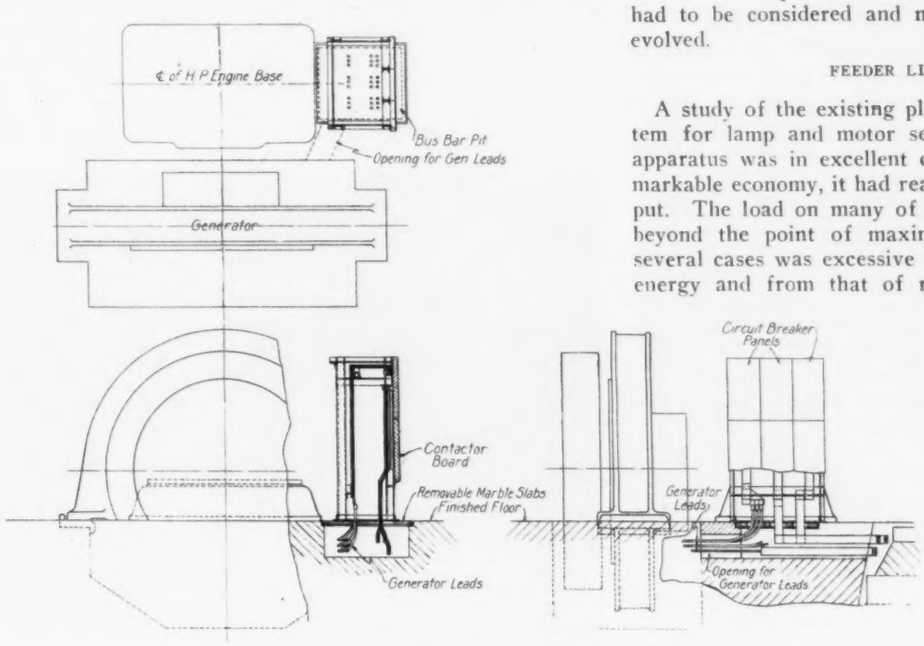


Fig. 6—Generator Contactor Board in New Engine Room.

PRELIMINARY STUDIES FOR THE NEW INSTALLATION.

The new system was primarily intended to be so arranged that any reasonable extensions and changes could be made at a minimum cost. Records of the cost of making such changes and extensions in the past indicated that it was best to install a system of even relatively high first cost for the purpose of securing maximum convenience both in amount and character of service provided and in the ease and rapidity with which extensions and changes could be made, and to remove all abandoned work, provided such a system would be the cheapest in the end. After much study it was therefore decided to install distributing systems for lamp and motor service and for low-tension work consisting of a complete system of primary distribution that would take care of the maximum possible service at all points, and an exceedingly flexible system of secondary distribution. A study of the history of the existing installation indicated that, while such a primary system might seem large and expensive over a considerable part of the proposed installation, yet there was every likelihood that the demands made upon any part of it might at very short notice rise to the maximum.

Thus it was proposed that certain sections of floors which were intended for filing cabinets should be equipped with empty conduits in the same manner as the most heavily loaded section on any floor, so that any change in the character of the furniture used in these sections could be arranged for without any extensive alterations. The result was the equipment of all floors in a similar manner for the maximum conditions so far as the main centers of distribution were concerned and also the equipment of every floor alike with a secondary distribution system so far as conduits and sub-distribution centers were concerned, but to wire up the secondary system to meet only the actual conditions existing at the time of installation. The wisdom of this decision has already been demonstrated.

The conditions imposed therefore generally barred precedent in the design of the equipment. In many cases new and radical departures from the usual methods of wiring had to be considered and new standards of construction evolved.

FEEDER LIMITATIONS.

A study of the existing plant and main distributing system for lamp and motor service showed that, while the apparatus was in excellent condition and operating at remarkable economy, it had reached the safe limits of its output. The load on many of the feeders had increased far beyond the point of maximum economy. The drop in several cases was excessive both from the view of wasted energy and from that of regulation. On some lines at times of maximum load the maximum temperature rise permissible with due regard to safety had been reached.

While it was thus evident that the distributing system required more or less extensive remodeling, consideration of the proposed immediate and future building activities showed that any further extension of the two-wire system would be uneconomical, if not impossible. Some of the groups of feeders to the proposed buildings on the two-wire basis would be enormous both in size and in cost, in one case reaching an estimated cross-section of 72,000,000 circ. mils in each leg, if even a reasonable drop and regulation were to be obtained.

Furthermore, the apparatus required to augment the capacity of the existing plant could not be located in the engine-room, the only space available being the west corner of the first floor and basement of the North Building addition, a condition that meant the separation of the new and the old engine-rooms by the combined widths of the new and old boiler-rooms (Fig. 5).

SWITCHBOARD LIMITATION.

Since the existing switchboard was considerably north of the electrical load center of the entire group of buildings, both present and proposed, it did not seem wise to move it any further north, even though the largest portion of the final generating plant had to be in the north engine-room. This situation produced the interesting condition

of an ultimate additional generating equipment rating of 1500 kw nearly 200 circuit ft. from the switchboard and the existing equipment of 800 kw at an average electrical distance of 45 ft. Hence, if each machine was to be separately connected to the board in the usual way, the aggregate of the generator leads would be very great.

The existing switchboard was approximately 37 ft. long. To add to it sufficiently to handle the new units and also the feeder controls for new and proposed buildings would have increased its length to 80 ft., making it unwieldly and also rendering it necessary to rebuild the board so as to place all feeder switches on a gallery. Investigation showed, however, that it was impossible to obtain space for the multiplicity of heavy leads and feeders in the cellar or passageway of the old building. In other words, even had it seemed advisable to rebuild the old switchboard, rather than abandon it, it would have been impossible to bring the necessary connections to it. These and numerous other considerations of a practical nature indicated that it was best to recommend placing the entire equipment, both old and new, on a 120-240-volt, three-wire basis, to abandon the old switchboard and arrange for the remote-control method of operating the electrical plant and distributing system, the center of distribution being removed from the old engine-room to a convenient point in the basement of the new building as far east as possible so that the heavy feeders to proposed buildings farthest from the plant would be correspondingly shortened.

This work has been carried out and the entire distributing system for the low-tension work remodeled without interruption of the service. No one outside of the engine-room force was aware of the time the change-over occurred. It is interesting to express the belief, in passing, that the Prudential Buildings possess the first remote-control switchboard designed for a direct-current plant.

THE NEW GENERATORS.

In order to provide for the immediate increase in the load and to relieve the old plant it was considered advisable to install at once two 500-kw generators with space in the new engine-room for a future unit of the same rating. Space conditions required the use of vertical engines; economical operation required that they be compound. Fig. 5 shows a view of the new engine-room.

The 500-kw units rest on a monolithic foundation of concrete reinforced with a grillage of I-beam in three tiers. The generator pits are lined with sheet steel, the pans being set on brick piers, weighted down, and the concrete poured around them.

The generators are of Sprague Electric Company's make, and operate normally at 150 r.p.m., with 235 volts at no load and over-compound 5 volts from no load to full load. They are built on 800-kw frames and show a test temperature rise in the windings of 29 deg. C. by thermometer after four hours' run at 25 per cent overload, succeeding a full-load run for eight hours. The engines are of Ball & Wood make of the cross-compound type. Owing to the cramped space conditions in this room lengthwise of the shafts it was impossible to provide for proper and accessible generator terminal boards in the generator pits, and hence the armature flexible leads and the series field-coil connections are brought directly to the generator contactor board, as shown in Fig. 6, on the rear of which is mounted the series field-circuit shunt. Thus the board serves the double duty of a generator terminal board and a generator switchboard panel. On this board are mounted three solenoid-operated single-pole switches, positive, negative and equalizer respectively, the negative switch being provided with an overload coil and all three electrically interlocked. An ammeter and a voltmeter were also provided on each of these boards, both instruments being duplicated on the control board in the old engine-room on Bank Street.

110,000-VOLT TRANSMISSION SYSTEM OF THE PROVINCE OF ONTARIO.

Specifications and Tests of Suspension Insulators, Cable Clamps and Strain Insulators—Aluminum Cable Data and Method of Erecting Transmission Line.

IN the previous issue the general organization of the Hydro-Electric Power Commission of Ontario was outlined, together with the preliminary work in surveying the line. In addition data were given on the cost of preparing for and erecting the transmission towers, followed by the specifications for the standard forms of towers employed. In the present article the painstaking work of the engineers in their investigations on insulators and in making comparative tests of the various types of insulators submitted is covered, as well as the methods employed in erecting the aluminum cable. The following article will take up the design and equipment of the various stations, while the concluding article of the series will deal with the low-tension transmission lines connecting the various municipalities with the stations.

INSULATORS.

Suspension-type insulators are used exclusively on the high-tension system. The specifications call for an insulator capable of withstanding an electric strain of 330,000 volts (three times normal) dry, 220,000 volts (twice normal) under a precipitation of ½ in. of water a minute at an angle of 45 deg. and a mechanical longitudinal stress of 8000 lb. The strain insulators employed to take up the

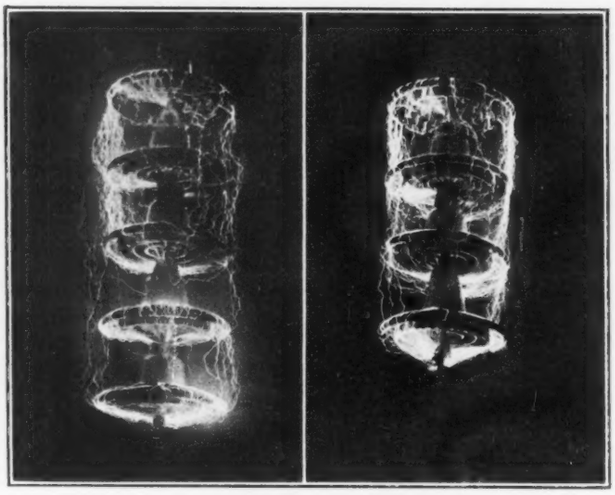


Fig. 16—Insulators Under Test.

horizontal strain on the cable were required to withstand a tensile load of 10,000 lb. without injury.

A number of insulator factories were visited before these specifications were prepared. Data were collected regarding methods of manufacture, and the facilities of the various manufacturers for producing insulators of the required quality in sufficient quantities were investigated. The data secured from the insulator tests carried out at the different factories were so varied that the commission decided to make independent comparative tests for the various types, all to be made under similar conditions. For this purpose three complete sample insulators accompanied each tender.

The insulator tests were performed in the transformer station of the Ontario Power Company at Niagara Falls, Ont. This company courteously offered the commission the use of all necessary apparatus, machinery and power, and during the tests assisted the commission's engineers. The 330,000-volt dry test (Fig. 16) was performed in all

cases, but the 220,000-volt rain test constituted the real test of efficiency. The water was applied through a series of spray nozzles directed toward the insulators at an angle of 45 deg. The flow was adjusted to give a precipitation of as much as ½ in. a minute, which was called for in the specifications. The nozzles were arranged

Fig. 17—Standard High-Tension Suspension Insulator.

to subject all insulators to exactly the same conditions. These tests were performed in absolute darkness, and a large number of photographs were taken to compare the more or less vivid luminous display due to leakage and flash-over. The mechanical strength of the sample insulators submitted was also investigated, and a large number of tests were performed to ascertain the ultimate breaking loads.

All tests were made entirely independent of the prices submitted in the various tenders, and the question of cost was not considered until after the final selection, based on the above tests, had been made. As evidence of the thoroughness of the tests and inspection of quality of manufacture, it may be mentioned that during the year the system has

Fig. 18—Standard High-Tension Suspension Insulator Clamp.

been in operation no interruption has occurred through mechanical or electrical insulator trouble. An insulator of American manufacture was finally chosen after a few alterations in design had been made at the recommendation of the commission's engineers. The suspension type of insulator consisted of eight sections with a ball and socket connection, as shown in Fig. 17. The strain type consisted of ten reinforced sections with similar connections. These insulators were shipped assembled in crates to various railway sidings, and from there transported by team to the tower sites. The eight-section suspension-type insulators were used on standard towers. The ten-section strain type of insulator was used on the line anchor and the corner and long-span towers, and on all special towers at railway, transmission-line and navigable water crossings.

The suspension-type insulators weigh, assembled, about 100 lb. and have an over-all length of 5 ft., including the clamp. They are attached to the tower cross-arm by means of an eye-bolt, which in turn is suspended from a galvanized U-bolt supplied by the tower contractor and placed in position by this assembling gang. The work of raising and attaching suspension insulators was done by a gang of three men and a foreman, the insulator being raised to the arm by a line and pulley, the eye-bolt slipped into the socket in the cap of the top section and then keyed in place with a small cotter pin. The greater portion of this work was done in the winter and the rate of progress varied considerably, but under favorable working conditions this

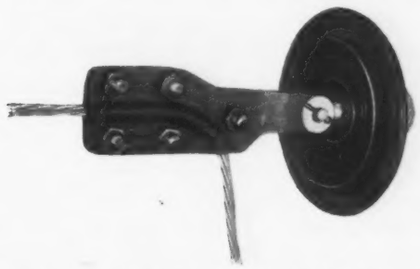


Fig. 19—Standard High-Tension Strain Insulator Clamp.

gang could cover forty towers a day on single-circuit sections, three insulators to a tower. The strain insulators were not erected by this gang, being delivered where required and later erected by the cable gang.

The cable clamp employed with the standard suspension-type insulator is shown in Fig. 18. It was specially designed for this insulator and consists of a malleable-iron casting with supporting grooves and a bolted cast clip for clamping the cable. An aluminum sleeve of 1/16-in. plate surrounds the cable and serves to protect it from abrasion. The clamp for the suspension insulator is also provided with two galvanized sheet-iron shields, which project over the cable at either end of the clamp and prevent any burning of the cable by short-circuits occurring from the flash-

Fig. 20—Cable Splicing on Heavy Anchor Towers.

over or failure of an insulator. All clamps and iron and steel parts are galvanized.

The strain insulator clamp, illustrated by Fig. 19, consists of two ¼-in. galvanized pressed-steel plates bolted together and provided with grooves to receive the cable. Aluminum sleeves and iron shields are also employed with these clamps to protect the cable from abrasion and burning.

During the course of construction it was found advisable to place a portion of the supply of materials with a European insulator manufacturer, who furnished insulators of the same design and quality as those supplied by the American company. The total order for insulators was 11,000 of the suspension type and 3000 of the complete strain type, together with the necessary clamps, sleeves and shields.

CABLE.

With the exception of about 3 miles of copper circuit within the city limits of Toronto, aluminum cable was used throughout the system. Two sizes were employed, No. 0000 B. & S. gage being used on the double-circuit line from Niagara Falls to Dundas, and No. 000 throughout the rest of the system. The cable was delivered on the field in reel lengths of 4000 ft., and has the dimensions and characteristics specified in Table IV.

TABLE IV.—CABLE DIMENSIONS AND CHARACTERISTICS.

	No. 0000	No. 000
Over-all diameter	.530 in.	.470 in.
Number of strands	7	7
Diameter of strands, average	.1756 in.	.1559 in.
Elastic limit, pounds per square inch	14,000–15,000	14,000–15,000
Ultimate strength, pounds per square inch	24,000–27,000	24,000–27,000
Conductivity	61	61
Weight per mile	1050 lb.	816 lb.
Total miles single aluminum cable erected	312.2	673.8
Total weight of aluminum cable erected	164 tons	275 tons

The cable gang consisted of twenty-five men, one foreman, one sub-foreman and two teams. The reels were set up on portable frames and were run out three at a time by a team. As each tower was reached the cable was raised to the cross-arm and placed on wooden pulleys, which were suspended at the same height as and beside the cable clamps. When the three reels lengths had been run out one span on each line was adjusted for sag by the commission's inspector, the sags on the other spans being allowed to adjust themselves over the pulleys.

The cable was then snubbed and men working on swings suspended from the arms removed it from the pulleys and clamped them to the insulators. While this was being done part of the gang with the sub-foreman and the other team worked in advance erecting ground cable. The ground cable is 5/16 in., seven-strand galvanized steel. This was pulled up to the proper sag and clamped directly on the towers. On the double-circuit towers with two power circuits (Fig. 21) three ground cables are used, and with one power circuit two ground cables are employed. The single-circuit towers are equipped with only one ground cable.

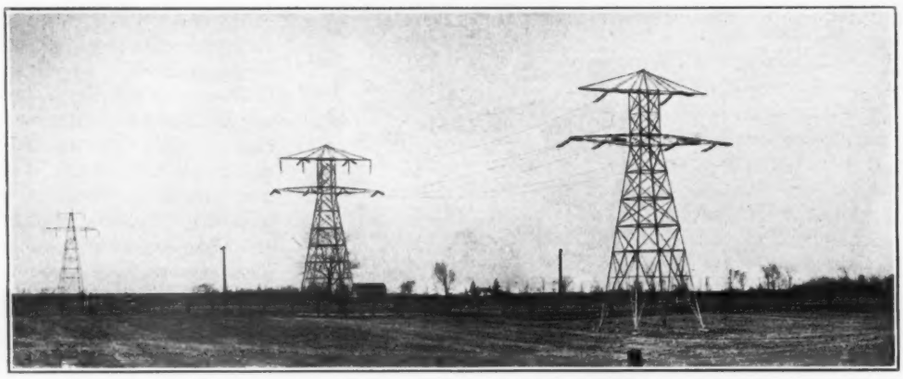
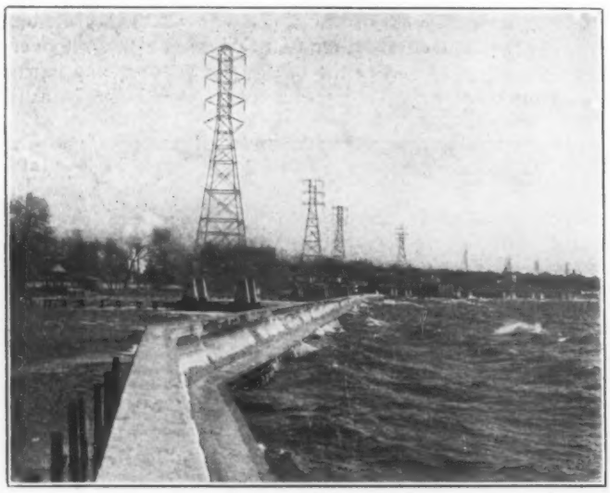
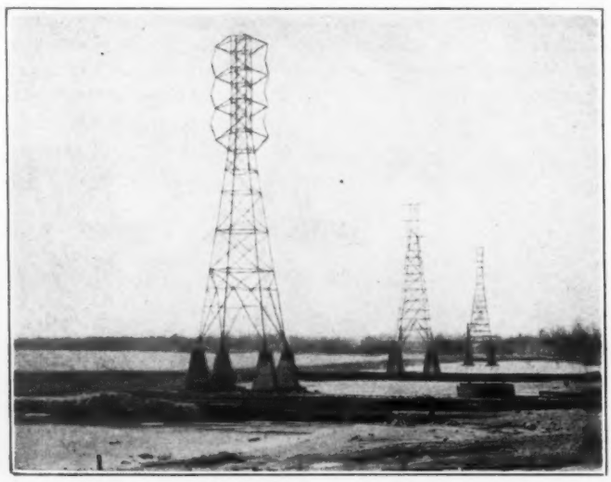


Fig. 21—Typical Double-Circuit Transmission-Line Railroad Crossing.

Cable splicings (Fig. 20) were made by means of 18-in. and 22-in. aluminum McIntyre sleeves, the specifications calling for two and one-half complete turns of the sleeve. The ground cable splices were made by means of a specially designed connector. Cable sags were adjusted in the field according to sag tables which were compiled with reference to temperature and length of span. Calculations were based on the assumption that the cables would be stressed to the elastic limit at 32 deg. Fahr. with a ⅜-in. coating of ice and a 65-mile gale. The minimum ground clearance allowed was 20 ft.

The rate of cable erection varied greatly, depending not only on weather conditions and topography, but upon the number of railways and transmission lines encountered The erection of strain insulators and the forming and adjusting of loops on anchor and crossing towers seriously affected the progress of the work on some sections of the line. On double-circuit sections, where six power cables and three ground cables were erected, the average rate of erection was from ½ mile to 6/10 mile of completed line a day. The labor cost varied from $110 to $215 per mile, the average being $130 for a mile of completed line. The rate of erection for three power cables and two ground cables was from ½ mile to ¾ mile of line a day, and the labor cost averaged about $80 for a mile.





Figs. 22 and 23—High-Tension Transmission Lines in Humber Bay, Toronto Entrance.

SPECIAL CONSTRUCTION.

The most important special construction was within the corporate limits of Toronto, where the high-tension line (Fig. 22) is carried to the Strachan Avenue station. This section of line is supported on towers giving 70-ft. minimum ground clearance, and for a distance of about 1 mile the towers are located in Lake Ontario (Fig. 23), 200 ft. from the shore. Reinforced-concrete piers, cross-braced with steel girders 15 ft. above water level and protected at their bases by heavy hand-laid riprap, are employed to support the tower bases.

LOGARITHMIC CHART FOR CALCULATING THE FREQUENCY AND WAVE-LENGTH OF OSCILLATING CIRCUITS.

By R. H. Marvin.

IN the use of oscillations produced by the discharge of a condenser through an inductance, as in wireless telegraphy, for example, the frequency and wave-length of the oscillation are usually calculated from the values of the inductance and capacity. The formulas used, although simple, become rather tedious if many calculations are required. To simplify and shorten this calculation the straight-line chart shown herewith was designed to give the result at one operation.

The formula for representing the frequency of a condenser discharge should really include the resistance of the oscillating circuit, but since the resistance over a considerable range has only a very slight effect on the frequency, and in any practical oscillating circuit the resistance must be kept low on account of the losses, it is usual and quite permissible to neglect the resistance.

The formula for frequency when the resistance is neglected is:

$$f = \frac{1}{2\pi\sqrt{LC}} \qquad (1)$$

where

f = frequency in cycles per second,
L = inductance of circuit,
C = capacity of circuit.

Here L and C must both be expressed in the same system of units, either electromagnetic or electrostatic. If, as is more convenient, L is expressed in centimeters or absolute electromagnetic units (1 henry equals 10^9 centimeters), and C in microfarads, this formula reduces to:

$$f = \frac{5.033 \cdot 10^6}{\sqrt{LC}} \qquad (2)$$

The velocity of propagation of electric waves being the same as that of light waves—that is, 3.10^8 meters per second—the relation between frequency and wave-length is:

$$l = \frac{3.10^8}{f} \qquad (3)$$

where

l = wave-length in meters.

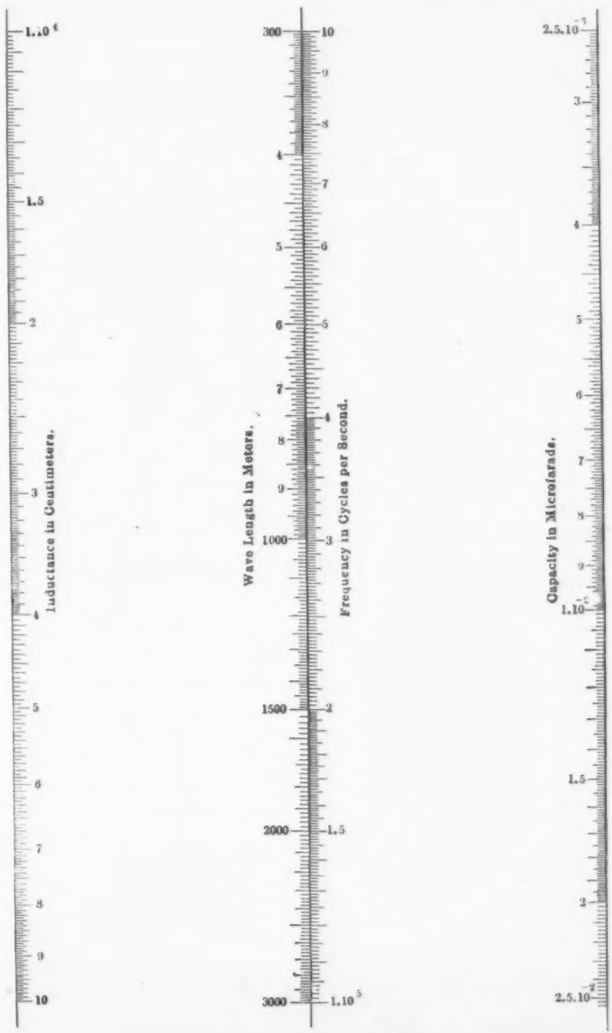
The chart has been laid out from formulas (2) and (3). It consists of four logarithmic scales so proportioned and located with respect to each other as to give the required result by a single operation. (The scales were copied from a 10-in. slide-rule.) As drawn it gives directly the values of frequency from 100,000 cycles to 1,000,000 cycles, and wave-lengths from 300 m to 3000 m; for inductances from 10,000 cm to 100,000 cm, and for capacities from 0.0025 to 0.025 mfd. As will be shown, it can be applied to all values of the variables.

To use the chart a straight-edge is placed so as to cross the selected value of the inductance on the upper scale and the selected value of capacity on the lower scale. The intersection of the straight-edge with the middle scales shows either the frequency or the wave-length. A thread stretched taut is a convenient substitute for a straight-edge.

Example I.—A condenser having a capacity of 0.008 mfd discharges through an inductance of 60,000 cm; what are the frequency and wave-length of the oscillation? A straight-edge placed 6×10^4 on the upper scale, and 8×10^{-3} on the lower scale crosses the middle scale at a frequency of 230,000 cycles and a wave-length of 1300 m.

It will be noted that the chart can be used also to determine what inductance or capacity to use with a given inductance or capacity to produce a certain wave-length.

Example II.—It is desired to use a condenser having a capacity of 0.005 mfd to give a frequency of 600,000 cycles; what inductance should be used? A straight-edge placed at 5×10^{-3} on the lower scale and 6×10^5 on the middle scale crosses the upper scale at 14,000 cm, the required inductance.



Logarithmic Chart.

For values of inductance or capacity greater or less than those given on the chart the following corrections must be made. As is shown by the formula, the frequency varies inversely as the square root of both the inductance and capacity. Therefore, if either the inductance or capacity be multiplied by any number, the frequency is divided by the square root of that number. Thus a capacity 100 times as large as a value shown on the chart would produce a frequency one-tenth of the value indicated.

Example III.—What frequency will be produced by a condenser of 2 mfd and an inductance of 3 millihenrys?

Two microfarads is 100 times the value on the chart, 3 millihenrys is also 100 times as large as the chart value. The actual values being each 100 times as large as the chart values, the frequency given by the chart must be divided by $\sqrt{100} \times \sqrt{100} = 100$. The value given by the chart is 205,000 cycles; dividing this by 100 gives 2050 cycles as the actual value.

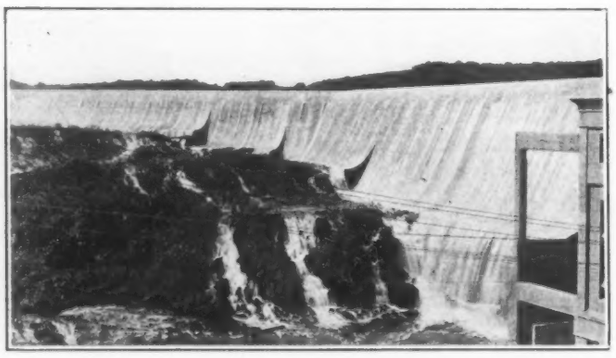
In case the chosen inductance or capacity is ten times or one-tenth as large as that shown on the chart, the frequency will be equal to the chart value divided or multiplied by $\sqrt{10} = 3.162$. This multiplication or division may be performed on the chart as follows: From the point where the straight-edge crosses the middle scale lay off on the middle scale a distance equal to one-half the length of the middle scale. This distance may be laid off either to the right or left whichever way makes it fall on the scale. The point so found will be the desired value. Laying off the half scale length to the right multiplies by 3.162, and laying it off to the left divides by 3.162. As the result of multiplying by 3.162 is the same numerically as that of dividing by the 3.162 only ten times as great, a multiplication by ten will correct the result when it is desired to multiply by 3.162 and where obliged to divide.

Example IV.—What frequency will be produced by a capacity of 0.0003 mfd and an inductance of 25,000 cm? The value of capacity is one-tenth that given on the chart. The result must therefore be multiplied by 3.162. The intersection on the chart gives 582,000. Laying off to the left one-half the scale length—that is, dividing by 3.162—gives 184,000. Multiplying by ten gives the required result, 1,840,000 cycles.

PROTECTION OF DAM AGAINST VACUUM VIBRATIONS AT FLOOD DISCHARGES.

In the discussion provoked by recent dam failures attention has been directed by several engineers to the vacuum which may be produced under the falling water curtain during flood discharges over the spillway. Besides adding to the total downstream pressure on the dam, such a vacuum may give rise to trouble on account of its pulsations, as it is alternately destroyed and reformed, setting up vibrations in the heavy structure of the dam.

The Cannon Falls dam of the Consumers' Power Company, near Cannon Falls, Minn., has been specially protected

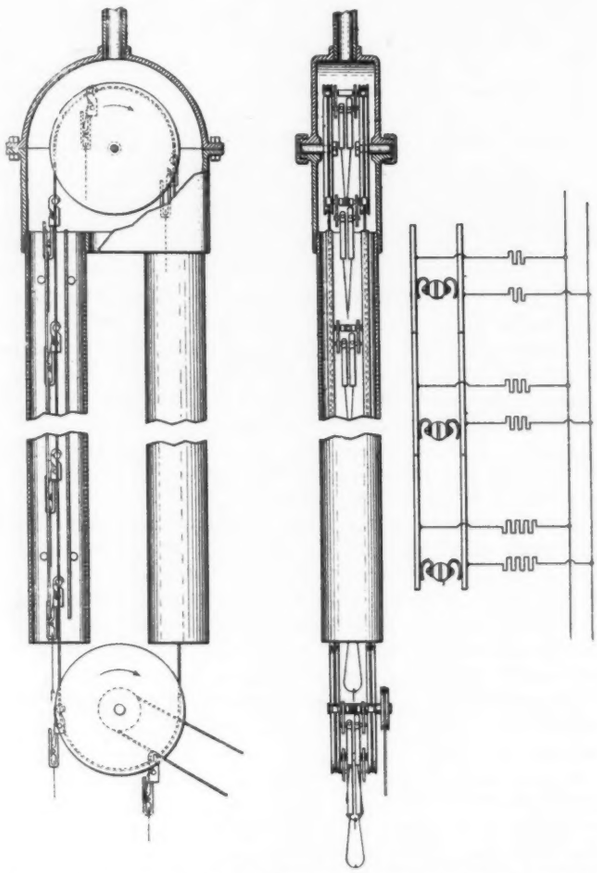


Cannon Falls Dam.

against the occurrence of such a vacuum by the insertion of vent-holes through the spillway apron, as shown in the accompanying illustration. These vent-holes just below the crest of the dam effectually prevent the formation of any vacuum which might produce the tremors already referred to. The Cannon Falls dam is of the hollow, reinforced-concrete type, and was built under the Ambursen patents.

MACHINE FOR CONTINUOUS TREATMENT OF TUNGSTEN FILAMENTS.

In the manufacture of wire-type tungsten-lamp filaments the mineral in its powdered condition is usually mixed with a binder material to form a plastic mass which can be formed into a filament by extruding it through a die. This



Apparatus and Circuits for Continuous Treatment of Tungsten Filaments.

filament is then heated in a suitable atmosphere of gases, removing the binder and causing the sintering of the metallic residue into a firm homogeneous thread.

A recent patent granted to William G. Abbott, Jr., of Schenectady, N. Y., and assigned by him to the General Electric Company, describes an improved device for giving this flashing treatment to tungsten filaments. A mixture of hydrogen and nitrogen, lighter than air, is commonly used, this gas mixture being held in the inverted U-tube, which, as shown, sheathes the endless-belt conveyor for the filaments. The gas is held in this inverted U-chamber by the greater specific gravity of the outside air, the losses by convection and diffusion being supplied through the pipe at the top. In putting the unformed filaments through the sintering process it is necessary that they be heated at first only slightly and later increased by steps to full temperature. The present device accomplishes this result by a series of contactors which engage the filament carriages during their passage of the tube. The first contactor, for example, has in series a high resistance, which cuts down the current through the filament to the proper initial value. Following contactors deliver higher potentials across the filament, so that in the travel of the latter through the tube the conditions of best temperature are successively closely reproduced. As the riders reach the bottom of their path the finished filaments are removed by hand and replaced by untreated threads.

Central Station
Management, Policies and Commercial Methods

A MINOR-REPAIRS CANVASS OF CUSTOMERS' EQUIPMENT.

Not long ago a large combination gas and electric company in the West inaugurated what it called a "canvass of customers." Representatives visited every consumer and inquired if the service was satisfactory. Permission was also asked, regardless of the answer to the first question, to make an inspection of the gas and electric appliances of the household. The men were prepared to make certain small adjustments and repairs, and also took orders for appliances, but did not specifically urge their sale.

In this case the inspection described resulted in a great deal of good. It proved to the customer that the company really wanted to know about the service its patrons were getting. The minor adjustments effected promoted satisfactory service and in many cases the use of more service by the customer. Many instances were found where, for some trivial reason, appliances were not used. In such cases fifteen or twenty minutes spent in adjustment, demonstration, etc., by an inspector removed all the difficulty and transformed a casual user into a good consumer.

DAILY INSPECTION OF HEATING CUSTOMERS' INSTALLATIONS.

In many exhaust-steam-heating plants, said Mr. A. E. Stevens, manager of the Consumers' Power Company at Minot, N. D., in talking of heating matters before the Byllesby convention recently held in Chicago, appreciation is lacking of the really important part the steam-heating end should play in plant production. While much attention is given to the electrical end of the station, the steam-heating system is often considered a sort of necessary evil, so that there is a consequent lack of careful attention to the many economies possible.

One of the greatest lessons in heating revenue is the stoppage of condensation meters. Another serious source of complaint which comes from consumers is due to the clogging of traps. Both of these troubles can be practically eliminated by daily readings and inspections during the heating season. The expense thus incurred will be found to be very small when compared with the increased revenue and the greater satisfaction of the consumers.

A careful system of costs should also be kept in the heating department, not only to make a proper financial showing, but because this will lead to a surprisingly large number of savings when these costs are analyzed.

THE CUSTOMER WHO FORGETS TO BRING HIS BILL.

From the standpoint of the accounting department it may seem perfectly justifiable to print drastic warnings and threats on customers' bills, and to post signs about the office to the effect that "Those who bring their bills will be served first; others must wait. Moral: Always bring your bill."

But the justice of this matter, as pointed out by Mr. William Hodge before the Byllesby convention, Jan. 4, at Chicago, does not appeal to the customer at all! He feels that when he goes to the office to pay a corporation it ought to take the money at once and without deliberately trying to put him to inconvenience because he has failed to bring a slip of paper with him.

Certain companies have attempted to overcome the duplicate-bill nuisance by penalizing the customer through compelling him to forfeit his discount. Surprising as it may seem, customers have actually been unjustly penalized in this way.

Unhappily, too, the customers who forget their bills are always the ones who come in about the last discount day, when a line is standing at the cashier's window. Making out duplicates then entails a digression from the regular order of business, and unless specially provided for delays the whole line.

But the fact should not be lost sight of that an office system or any other system is devised for the expeditious handling of business and not to gratify a mere sense of order. The friendship of the public, indeed, is worth incomparably more than the wages of a clerk or two, or the time lost in making out duplicate bills.

NEED OF ADEQUATE WIRING FOR HEATING APPLIANCES.

The household consumer should be encouraged in the use of electric irons, toasters, chafing dishes, percolators and other heating appliances, but, as pointed out by Mr. H. E. Morton, of Albany, Ore., it is a waste of time, energy and money to have these devices installed unless they can be used with convenience.

A certain family which he mentions has, for example, an electric iron, a toaster stove, a coffee percolator and a chafing dish. The good wife wanted to prepare a lunch, using the chafing dish for a rarebit, the stove for toast and the percolator for preparing coffee. The house was wired with only one lamp in each room, so that it was impossible to use these appliances on the dining-room table.

The toaster, therefore, had to be attached to a bedroom socket and toast made in the dark. The coffee was prepared in another bedroom, and the rarebit was made in the kitchen on the range, as the house wires were too small to allow operating all the appliances at once.

Large amounts of money are being expended in selling such heating appliances, but to the success of their use it is vital that sales be followed up with a campaign to have proper wiring installed, so that the appliances can be used. Contractors and architects should be educated on this subject, and all new houses should be wired so that the usual heating appliances can be used with convenience.

THE PUBLIC'S RIGHT TO COURTEOUS TREATMENT.

A distinct policy of the Byllesby companies has been that of unfailing courtesy and fair dealing toward the public served by these properties. The desirable relations thus established are of inestimable value to local companies when matters of franchise rights, extensions, etc., are involved. But, aside from such aspects of direct advantage to the corporation, there is a moral obligation to the public on the part of the utility company, as pointed out by Mr. W. H. Hodge in a paper read at the Byllesby convention, Chicago, Jan. 4.

"The public," declared Mr. Hodge, "has just as much right to expect courteous, prompt and pleasant attention from the officers and employees of a company as to expect good service in exchange for its cash and the monopoly privileges conferred. An employee who is polite to customers or prospective customers is merely doing his duty and performing what is expected of him and what he is

paid for. Courtesy to the public is neither condescension toward the customer nor giving the company more than its due. It is no special virtue for either corporation or employee.

"The kind of service a man receives is secondary to the kind of treatment his pride receives. If he believes the company treats him with respect and fairness he is willing to put up with a certain amount of interruption to the service without growing hostile. But if he bears a grudge against the company the best service and the lowest rates will not make him a friend. Because we operate monopolies we must treat our customers better than competitive business institutions, and we must make it plain to the public that such is the fact."

A CURIOUS ADVERTISEMENT.

The advertisement of the Union Electric Light & Power Company, of St. Louis, in the *Globe-Democrat* of that city on Jan. 10 was something of a curiosity. It consisted of a picture representing the pleased expression of a customer

A One-Line Advertisement.

owing to a reduced electric-light bill, with the delineation of an electric-lighted cottage, and also lettering calling attention to the fact that the combination of the new reduced rates and the tungsten lamp has made electric lighting the best and most economical illuminating agent. What makes the advertisement unusual is that the entire design, lettering, border and all, is executed with a single line, starting at the lower right-hand corner and ending in the center of the upper spirals. Differences in shading bring out the picture and the lettering. This advertisement, which is reproduced herewith, in the original occupied a space 6.25 in. wide and 9.25 in. long, and is said to be the largest "one-line" advertisement ever inserted in any newspaper.

WHAT THE CENTRAL STATION CAN DO FOR THE BUILDING CONTRACTOR.

A large merchandising syndicate having stores in a number of cities recently completed its new building, 100 ft. front and three stories high, at Fort Smith, Ark. Much time was lost in the preliminary work on this structure owing to improper ground for foundations. As the result of a number of vexing delays the contractors found themselves sixty days behind their schedule by the time the foundation structure was at last completed. From this point, however, it was determined to push construction with all haste, in the hope of cutting down the impending penalty imposed for delay by the contract.

The Fort Smith Light & Traction Company was at once asked to install fourteen arc lamps so that work could be carried on all night. These lamps were put in position promptly, and during the succeeding three months were moved about from place to place as the work progressed. For conveying material an elevator hoist was installed to serve all three stories. This hoist they equipped with a 5-hp single-phase motor, which was purchased outright by the contractor. The single-phase type was selected so that the motor might be used for other jobs elsewhere in town. Since the completion of this building it has been transferred to and is working at a new site.

To aid the carpenters a 5-hp, two-phase motor was installed to drive the rip-saw. Another 3-hp motor operated a shaper or single-sided planer. Owing to an error in the drawings all of the steelwork for the store front arrived with holes improperly drilled, so that it was necessary to lay out this work all over again. Two portable electric drills were borrowed from the electric company for this purpose and did their work well.

During the three months the building was under forced construction the central-station bill averaged from $26 to $29 per month. By the end of this period, however, the contractor had caught up the sixty days' lost time and finally finished the whole job five days before the contract date.

COMPLETE ELECTRICAL EQUIPMENT OF AN APARTMENT HOUSE.

A model apartment house, from the standpoint of electrical equipment as well as that of general convenience and adaptability to any purpose, is now in course of construction in Louisville, Ky. The building is the Weissinger-Gaulbert Annex, a companion structure to the handsome ten-story apartment house on the opposite corner, which has the distinction of being the first strictly modern and the largest apartment house erected south of the Ohio River.

The Weissinger-Gaulbert Annex fronts for 80 ft. on Broadway and extends southward for 200 ft. along Third Avenue. It is ten stories high and contains a long series of what are called "flexible" apartments, since their size may be regulated to include anything from a single room and bath to an entire suite through the simple expedient of double or single doors. The double doors separate individual apartments and the single entrances designate companion rooms. This idea constitutes the feature of the most approved type of apartment construction.

It was not enough, however, that the Wessinger-Gaulbert should be designed for the absolute convenience of its lessees in the matter of space desired, for the architects have made arangements to incorporate in the big building

every electrical convenience known to householders. A prominent feature of the electrical system in the Weissinger is its culinary departments. In the smaller apartments "kitchenettes" have been equipped with electric ranges, the cooking odors being drawn away by an electrically operated fan system. There is also an electrically operated vacuum cleaner for every apartment, so that the individual housework of the tenant may be decreased as materially as the outside work is decreased by the janitors, who keep the halls, reception rooms and the exterior in spotless condition.

In every pantry supplementary to the apartment kitchen there is a refrigerating system, the ammonia solution for refrigerating purposes being pumped through the coils by an electric pump which is centrally located in the building. The individual refrigerators contain removable receptacles which may be filled with water to produce ice in a few minutes, or which, if filled with the necessary constituents, will produce ice-cream and other frozen delicacies, as well as keeping all food in storage at the proper temperature.

The Weissinger is, of course, electrically lighted and ventilated. There are as many lighting fixtures in the interior as there would be in the most expensive hotel, with auxiliary sockets at convenient intervals in every room to accommodate such domestic conveniences in the way of curling-irons, toasters and portable reading lamps as may be desired.

Down in the basement there is a complete electric laundry for the benefit of tenants, with electric irons and a big superheated dry-room. The energy for this establishment of electrical comfort and convenience is supplied from the Weissinger-Gaulbert power house in the rear of the original structure across the street.

SUBURBAN IRRIGATION BY CENTRAL STATIONS.

By R. B. Mateer.

Without water all the efforts of the farmer are in vain, for dry farming, the hobby of those who seek to extract a living from dry and exhausted soil, has proved to be less of a boon than the anxious agriculturist fancied. Water is everywhere needed. Irrigation on a small scale has been

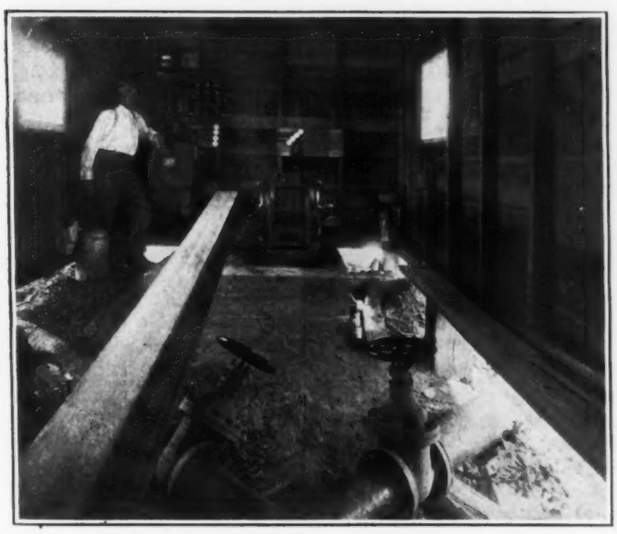


Fig. 1—Interior of Pump-House.

attempted in the West with windmills and gas-engine-driven pumps, but the water supplied was not sufficient for the needs of the thirsty soil. Next community reservoirs and small lakes were utilized to store water, this being distributed by ditches to the land which it was sought to render productive of crops. Trouble was experienced even here, for excessive charges per acre of land under cultivation added to regular assessments of a greater or less

Fig. 2—Transformers and Pump-House in Irrigation Field.

amount proved a burden to the farmer and rendered his livelihood more and more precarious.

With the combination of wells, internal-combustion engines and ditches a failure, the agriculturist began to consider the previously neglected electrical pumping proposition. First cost and operating expenses had seemed huge when compared with the lucid statements of costs made by the promoters of oil and gasoline pumping units and reservoirs and irrigation ditches. But hundreds of acres of land remained unsought as a result of the failures experienced by those who depended on the old systems of supplying water, and even in adjoining city limits there might often be found much ground which should be productive of crops of grain or vegetables.

The aggressive policy of certain central stations in authorizing the construction of the necessary pole line to reach such loads has resulted in many interesting and very profitable installations of motor-operated pumps. Water, when and where desired, is now turned upon the thirsty soil; vegetables in abundance supply the city markets and surplus quantities are crated and shipped to less favored sections of the state or country. Thus fruits and grain add to the wealth of the local county as the result of irrigation and motor-operated pumps.

A recent installation of this kind, promoted entirely with private capital, is that of Mr. M. A. Lunn, near Denver, Col. In this case 80 acres were supplied with all the water necessary to change dry, arid land to fertile, productive soil. A 35-hp, three-phase, 220-volt motor is belted to a centrifugal pump which is connected to two lines of 12-in. pipe, as shown in Fig. 1. The pump is capable of delivering 1100 gal. per minute against a head of 50 ft. The

water is pumped in two directions to discharge points 1320 ft. north and 1320 ft. south respectively of the pump house. From these heights of 50 ft. it is allowed to flow by gravity through ditches over the adjoining fields. The 13,000-volt transmission lines are tapped for this service, the pressure being reduced to 220 volts at the pump house. One interesting feature of this 13,000-volt transmission is its construction under the 100,000-volt transmission line which feeds from the Shoshone power plant.

All the water used is secured through filings made on seepage and underflow in a stream known as Dry Creek, an earthen breastwork serving to collect the water flowing in the creek and such seepage as the lands situated on higher levels may supply.

Gasoline and oil-engine competition in this case was overcome by the efforts of the power department of the Denver Gas & Electric Light Company, which supplies the energy used. The results of the installation are not only satisfactory, but highly gratifying to the consumer, and will likely result in additional irrigation plants. In fact, such a pumping load is a revenue-producing installation for the central station, a boon to the agriculturist and a blessing to the public, which benefits from the resulting abundant crops and low prices.

Wiring and Illumination.

NOTES ON DIFFUSION OF LIGHT.

By J. R. Cravath.

Recent investigations by the author* have pointed strongly to the desirability of having light well diffused when it is used for working purposes. This is especially true in offices where the work is on paper and in factories where the work is on polished metal. The glare of regular reflection from the work which is received when there is too great a preponderance of light from one direction is very objectionable and causes a conscious straining of the eyes in the attempt to see. It is probable that this glare from the work is responsible for fully as much or more eye strain than the glare from exposed lamps about which so much has been said. It is frequently easier to avoid the glare from exposed lamps than to avoid the glare from the work. Inclining the head will frequently let the eyebrows shade the eye, but in dealing with irregular polished surfaces of metal or paper avoidance of glare from some portions is very difficult unless the system of illumination is such as to reduce this glare to a minimum.

The author has recently carried on some simple tests for determining under what conditions annoying glare from a reading page may be present and under what conditions it is least. The general conclusions of these investigations are that annoying glare from a commonly used half-tone paper, such as the *Electrical World* for example, can be obtained at certain angles under practically all conditions of ordinary commercial artificial lighting, and also with daylight as received through windows. About the only condition where glare is not present is out in the open under a cloudy sky, in which case the diffusion is so perfect and the light is coming from so many directions that no glare can be obtained from the paper. The most aggravating case of glare, of course, can be obtained with all the light coming from a bare lamp amid dark surroundings.

This glare from paper is simply a reflection of the light falling upon the paper. The conclusion is obvious, though not always well considered, that the glare from the paper is in general like that from the source of light which causes it. Testing out the matter in an ordinary small room with fairly light walls and ceilings, it was found that the glare is most annoying with a bare lamp without any reflector. The glare in this case is simply a modified reflection of the lamp filament, which is the chief source of light. Going a step further, conditions were somewhat improved by putting a reflector over the lamp. Although the amount of light coming direct from the lamp was not changed, a considerable amount of light was added from the interior surface of the reflector, so that the area from which glare was received was spread out on the paper and rendered less offensive. To be sure, it was far from comfortable, but it was far less objectionable than with the bare lamp.

With the lamp and reflector a removable frosted tip made of tracing paper was tried and a comparison with the clear lamp was made by suddenly removing this tip. The results were not enough better with the frosted tip to justify much insistence in the matter of frosting. In most cases the glare was annoying enough to prevent reading in certain positions. Removing the lamp and reflector further from the page caused a reduction in annoyance for the obvious reason that a larger percentage of the total light on the page was received from sources other than direct from the lamp and reflector the further the lamp and reflector were removed. With indirect lighting the glare was still further reduced and reading became possible at all angles where before it would have been impossible. However, even with this there was a very marked difference in the comfort of reading at various angles. The light coming from a large ceiling area spreads out the area of glare on the paper and reduces the intensity of the glare. With only one source of indirect light in a room a person holding a paper to read will naturally seek an angle which avoids this glare just as he would if the glare were more localized and came from a direct light source. The same thing was true with light coming through a window. The glare was in this case spread out, but one would naturally seek the most comfortable angle for reading, which would be one where the glare of reflection from the sky was not received.

These preliminary tests having been made, it became a matter of interest to learn the distribution of light as received upon any given point in a room under certain conditions and to learn under what conditions reading is naturally done when the reader is free to hold the page at any angle, as is the case in ordinary reading when one is not working on a desk. It has been realized in general in the past that for general office lighting, for example, it is desirable, unless individual desk lamps are provided, to have light coming from a number of directions to avoid annoying shadows. There is also another reason not so much considered, which is that of avoiding annoying glare from paper. The tests here reported do not take up the matter of lighting where there are a number of lamps in the room, but simply show conditions in certain small rooms with but one source of light. It is probable that in the future more consideration will be given to this matter of the predominant direction of light and the quality of light received on any given horizontal surface, as expressed in the percentages received from various directions.

The following tests were made:

In test No. 1 the room was 12 ft. by 16 ft. with 8½-ft. ceiling. The walls were light green and the ceiling very light cream. An indirect lighting fixture with moderately concentrating reflectors was hung in the center. The photometer was first placed at a position on the center line of the room at a 3-ft. horizontal distance from the center fixture. The test plate of the photometer was 3 ft. above the floor. The photometer was placed so that the observer faced the center of the room and the test plate of the photometer could be rotated in a plane passing through the center of the room. A reading page was first held at the position of the photometer plate by a person seated as in ordinary reading, this person facing the center of the room. In this position, if the paper was held horizontally, the glare was not very annoying, but was nevertheless present

*"Effectiveness of Light as Influenced by Systems and Surroundings," *Trans. Ill. Eng. Soc.*, November, 1911.

in sufficient quantity to make one instinctively tilt the paper to a more comfortable angle. The most comfortable angle selected by the author for reading was 30 deg. from the horizontal. He was influenced to make this selection partly on account of bringing the page to proper position with reference to the eyes and partly because this position gave the maximum of illumination obtainable without glare from the paper. Moving the paper further forward caused some glare, while moving it further back reduced the illumination on the page. After this 30-deg. angle had been determined for this case readings were taken with the photometer at various angles in a vertical plane passing through the center of the room. The results are shown in Table I.

TABLE I, SHOWING FOOT-CANDLES AT VARIOUS ANGLES IN VERTICAL PLANE PASSING THROUGH CENTER OF TEST-ROOM NO. 1, WITH PHOTOMETER 3 FT. FROM CENTER, ON CENTER LINE OF ROOM; INDIRECT FIXTURE IN CENTER.

Angle of Test Plate from Horizontal.	Foot-candles.
45 deg. back	0.92
30 deg. back	1.75
15 deg. back	2.30
0 deg. horizontal	2.90
15 deg. forward	3.00
30 deg. forward	3.10
45 deg. forward	3.10

From Table I it will be seen, as might be expected, the illumination falls off very rapidly as the paper is tilted away from the center of the ceiling, which is the source of light in this case. When the plate is tilted toward the center the illumination is almost uniform over a considerable range. In order to get comfort a reader will actually select a position of the paper which gives considerably less illumination on the paper than if it were held horizontally. The reader's position, however, in this case, facing the center of the room, is somewhat unnatural, and a position at right angles to the first position with one side to the center of the room would more commonly be taken by one desiring to read continuously. To explore the conditions just described, the photometer was rotated around 90 deg. from the plane in which the tests in Table I were taken, so that the photometer plate could be rotated in a vertical plane at right angles to the vertical plane passing through the center of the room. The position of the test plate was 3 ft. from the center of the room as before. A reader seated with paper in the position of the test plate in this case would receive no annoying glare at any of the angles tested. The results are given in Table II.

TABLE II, GIVING FOOT-CANDLES OBSERVED IN TEST-ROOM NO. 1; PHOTOMETER TEST PLATE 3 FT. FROM CENTER OF ROOM AND MEASUREMENTS TAKEN AT VARIOUS ANGLES IN A VERTICAL PLANE 90 DEG. FROM THE VERTICAL PLANE PASSING THROUGH THE CENTER OF THE ROOM.

Angle of Test Plate from Horizontal.	Foot-candles.
45 deg.	1.44
30 deg.	2.40
15 deg.	2.60
Horizontal	2.90

The photometer was then moved to a position directly under the fixture in the center of the room. At this position the angle of the paper selected by the writer for most comfortable reading was 28 deg. from the horizontal. Photometer readings in a vertical plane passing through the center of the room resulted as shown in Table III.

TABLE III, FOOT-CANDLES AT VARIOUS ANGLES IN A VERTICAL PLANE WITH PHOTOMETER LOCATED DIRECTLY UNDER INDIRECT FIXTURE IN CENTER OF TEST-ROOM NO. 1.

Angle of Test Plate from Horizontal.	Foot-candles.
45 deg. back	1.2
28 deg. back	2.7
0 deg. horizontal	3.4
28 deg. forward	2.8
45 deg. forward	2.2

It will be noted that in all of the foregoing tests a position giving considerably less than the horizontal foot-candles is naturally selected.

Test-room No. 2 was a room about 10 ft. square with 8½-ft. ceiling, light blue walls and white ceiling. The lighting equipment was a single lamp with prismatic reflector giving extensive type of distribution at the center of the ceiling. The first test in test-room No. 2 was made as in test-room No. 1, namely, 3 ft. away from the center and facing the center. In this position the angle selected by the reader for most comfortable reading was 20 deg. from the horizontal. With the paper held horizontally reading was impossible on an *Electrical World* page because of the glare. The results are shown in Table IV.

TABLE IV, SHOWING FOOT-CANDLES AT VARIOUS ANGLES IN VERTICAL PLANE PASSING THROUGH CENTER OF ROOM NO. 2, WITH PHOTOMETER 3 FT. FROM CENTER AND WITH LAMP AND PRISMATIC EXTENSIVE REFLECTOR AT CENTER OF CEILING.

Angle of Test Plate from Horizontal.	Foot-candles.
40 deg. back	0.5
20 deg. back	0.8
0 deg. horizontal	1.17

The test was not continued forward from the horizontal as in Table I, but the results in general would doubtless have been about the same.

With the photometer located in the center of test-room No. 2, with direct lighting as before, the angle selected for comfortable reading was 38 deg. from the horizontal. Table V shows the distribution of light in a vertical plane as measured by a photometer under the lamp in the center of the room.

TABLE V, FOOT-CANDLES IN VERTICAL PLANE, ROOM NO. 2, PHOTOMETER IN CENTER.

Angle of Test Plate from Horizontal.	Foot-candles.
45 deg.	0.57
38 deg.	0.88
15 deg.	1.16
0 deg. horizontal	1.20

In this case also the glare from the paper held horizontally with a person seated under the lamp in the center prohibited reading.

In order to test the effect of much lighter colored walls

upon distribution of light and glare, another set of tests was made in a room entitled test-room No. 3. This room was about 13 ft. by 16 ft. with 8-ft. very light yellow ceiling and slightly darker yellow walls. The lighting was indirect from a center fixture. The reflector used in this case gave a somewhat wider distribution of light over the ceiling than in test-room No. 1. The practical effect of this, together with the light-colored walls, seemed to be to require the reader to tilt his paper to a greater angle from the horizontal than in test-room No. 1. The angle selected in this latter case was 35 deg., as against 28 deg. in test-room No. 1 with the reader under the fixture in the center. On the other hand, when moving back 3 ft. from the center of the room and seating the reader facing the fixture, the latter selected an angle of only 20 deg. from the horizontal in test-room No. 3, as compared with 30 deg. for a similar position in test-room No. 1.

The results obtained from photometer measurements in a vertical plane under the fixture in the middle of the room in test-room No. 3 are given in Table VI.

TABLE VI, GIVING FOOT-CANDLES IN VERTICAL PLANE THROUGH THE CENTER OF THE ROOM AS MEASURED FROM A POINT DIRECTLY UNDER THE CENTRAL INDIRECT-LIGHTING FIXTURE IN TEST-ROOM NO. 3.

Angle of Test Plate from Horizontal.	Foot-candles.
45 deg.	0.87
35 deg.	1.40
15 deg.	1.72
0 deg. horizontal	1.82

Moving 3 ft. back from the fixture and facing it where the angle of paper required for comfortable reading was 20 deg. from horizontal, the results shown in Table VII were obtained with the photometer.

TABLE VII, SHOWING FOOT-CANDLES IN THE VERTICAL PLANE OF THE CENTER LINE OF THE ROOM MEASURED 3 FT. FROM CENTER IN TEST-ROOM NO. 3, WITH PHOTOMETER FACING CENTER.

Angle of Test Plate from Horizontal	Foot-candles.
45 deg. back	0.28
30 deg. back	0.84
20 deg. back	1.05
0 deg. horizonta	1.45
15 deg. forward	1.52
30 deg. forward	1.48
45 deg. forward	1.49

Turning the photometer around to measure a plane 90 deg. from the plane explored in Table VII, the results in Table VIII were obtained.

TABLE VIII, GIVING FOOT-CANDLES AT VARIOUS ANGLES IN PLANE 90 DEG. FROM THAT EXPLORED IN TABLE VII, OR AT RIGHT ANGLES TO A PLANE PASSING THROUGH CENTER OF ROOM; PHOTOMETER PLACED 3 FT. FROM ROOM CENTER.

Angle of Test Plate from Horizontal	Foot-candles.
45 deg.	1.21
30 deg.	1.39
15 deg.	1.50
Horizontal	1.45

In test-room No. 3, with its light walls and ceiling and light reflected from a large ceiling area, there was no position of the paper in which reading was impossible. The glare which was received from the paper was perhaps a little worse than by daylight from a window.

The following conclusions can be drawn from these observations and others made on all kinds of lighting installations as regards glare from paper:

(1) The greater the proportion of light received on the paper from a single source the more pronounced the glare.

(2) The glare from a bare lamp without reflector is usually more annoying than for the same lamp equipped with a reflector.

(3) When the paper is tilted at proper angle direct lighting from one source of light is as satisfactory as indirect as far as the quality of light on the paper is concerned, but this applies only where the paper and any surrounding surfaces from which glare may be received are under the control of the reader.

(4) If a reader is receiving glare from the paper, less movement or tilting of the paper is required to avoid glare from exposed or direct light sources than with indirect lighting, but the glare is much more pronounced in the former case.

(5) Glare from paper with frosted-tip lamps as compared to a clear lamp is so nearly the same that there is no practical difference in the annoyance caused, the lamp being equipped with a reflector in both cases.

(6) In general, the sharpness and amount of shadow which can be obtained at any point in a room are a good indication of the amount of annoying glare which can be received from paper at certain angles in the same position. As sharp shadows are undesirable in themselves, this indicates that for general office and workroom lighting the illumination should be designed to give as little sharp shadow as possible.

(7) The foregoing conclusions indicate that for large office and factory rooms it is best to spread out the source of illumination as evenly as possible. If a direct-lighting system is used, this means that we should employ small units a short distance apart rather than large units at infrequent intervals. If indirect lighting is used, the more evenly the illumination is spread over the ceiling the better the results are likely to be.

This last conclusion, if carried out in small rooms, whether with direct or indirect lighting, will mean some loss of measured efficiency, because of the greater amount of light absorbed by walls with such design. However, the results will usually be so much superior as to justify the loss of efficiency.

NEW TELEPHONE PATENTS.

AUTOMATIC SENDER.

The dial of the automatic sender has been the subject of much study, and there have therefore been brought out many different types. Probably the easiest to manipulate are those having a finger hole for each digit, the dial being pulled in any case until the finger meets a stop piece.

The sender recently patented by Mr. E. E. Clement may be considered a modification of this, although the dial is stationary and the stop is movable. The dial has thumb notches numbered and a movable lever is placed within spanning reach, which lever terminates in a finger hole. To send a digit the thumb is placed in the proper notch and the finger placed in the lever hole and the finger is then brought into contact with the thumb, driving the lever the corresponding angle.

WATCHMAN AND TELEPHONE SYSTEM.

Mr. F. G. Duryee, of Fort Wayne, Ind., has obtained a patent for a combined watchman and telephone system. The watchman is equipped with a portable telephone. As he makes his rounds he signals on the clock system. If he

desires to talk he maintains the circuit closed longer than normal, whereupon a time-limit device rings the telephone bell of the head watchman, the portable set is plugged in on the line and the two may converse.

SUBSTATION APPARATUS.

Messrs. W. F. Taylor and V. Durbin, of Brookline, Mass., are the joint inventors of a desk stand set, the patent for which they have assigned to the Holtzer-Cabot Electric Company. Use is made of the base and tubular upright now practically standard, but the top of the upright comes off, carrying with it the transmitted and hook lever as well as two contact springs to which the transmitter terminals are connected. These contact springs press the stud carried by the hook switch lever. Within the tubular upright are mounted the contact springs to which the cords are attached. When the headpiece is pushed down home and secured its two contact springs span those in the upright and force them into the talking circuit relation. When the hook lever is depressed the spanning springs are separated and the contacts restored to the normal position.

A patent has been granted to Mr. P. C. Burns, of Chicago, for a collapsible desk arm. This is of the "lazy-tongs" type. The lazy-tongs terminates in a vertical rod. The transmitter and hook switch are mounted upon a short tube and this lies parallel to the vertical rod and is secured to it by a clamp. This latter consists of two leaves of brass each formed up to half span the rod at one end and the tube at the other. A screw at the middle serves to draw the leaves toward each other to tighten the clamp. This patent is assigned to the American Electric Telephone Company.

Letters to the Editor.

THE CALGARY PLANT—ALUMINUM HIGH-TENSION CONDUCTORS.

To the Editor of Electrical World:

SIR:—The editorial comment in your issue of Dec. 23 on the design by our firm of the Calgary Power Company's Works at Horseshoe Falls and on the use of aluminum conductors demands some explanation, and I trust what I offer below will interest your readers.

In 1908 we commenced construction with modest views and to serve a city of 25,000 people. Money was not plentiful, and our designs were completed on a basis of four units of 2500 kva each. Two of these were on order when a consolidation took place, when further and ample capital was secured, and the consulting engineer for the bond house recommended that the remaining units be designed of larger capacity to meet the demands of a rapidly growing city and to anticipate a lake storage or steam auxiliary service to carry over the low-water period of midwinter. Acting on his recommendation, new designs were made, and by placing sufficient flywheel effect in the generator rotors of units 3 and 4 the power house was kept to practically the same width as in the first designs, which made use of separate flywheels for regulation and therefore longer units. It was, therefore, as is quite frequently the case, finance and not engineering that created a seemingly inconsistent or immature design.

The station, as now laid out to accomodate a turbine capacity of 19,500 hp, would be equipped at low water on a daily load-factor basis of less than 30 per cent, which, considering the base load of cement mills, is too great; it can be justified only by the immediate creation of lake storage to increase the water available in midwinter, and this the company now has in hand.

Your suggestion for further information on the use of aluminum cables for high-tension transmission is timely and reasonable, and we can come to your assistance in some measure.

Because solid aluminum cables some years ago failed, many engineers yet view with distrust the use of stranded cable, though practice has so far advanced the art that to use it is now safe; but prejudice dies hard. Again, heat from a short-circuit will fuse it, but any short-circuit is so certain to fuse either copper or aluminum that the argument falls down. It may be added that the electrical engineer of the Canadian Railway Commission has finally consented to the use of railway crossings of aluminum on a parity with copper.

But your surmise that commercial conditions really govern the question is true, and this is the real Ethiopian. In the United States there is a Chinese wall 30 per cent to 60 per cent high to protect poverty-stricken manufacturers from ruin, and, of course, the aluminum manufacturer merely shades the copper market a trifle and stands pat: but in Canada the similar Chinese wall is not so high and there is still less protection against aluminum pig or rods. Thus, the product made at Shawinigan Falls, Quebec, although produced from alumina shipped from St. Louis, Mo., is sold at a price governed by British competition, and even aluminum rod is now being imported in small quantities and made into wire and cable in Ontario and Quebec mills.

During the past five years our firm has used aluminum almost exclusively for transmission purposes, except for very long spans, where in some cases copper-clad steel cables are adopted; and if we give due consideration to independent line troubles due to wind conditions, etc., I think it can be fairly said that extreme satisfaction has resulted. I do not think it would be proper here, without consent of the manufacturers, to quote actual prices, but it can be said that there is a large saving in Canada arising from the use of aluminum conductors at the price which we have been able to secure. The Calgary 55,000-volt line cost $2,000 per mile complete, which, considering the high freight rates and long team haul for poles, must be considered very moderate.

In conclusion, it may be of interest to tabulate the installations of aluminum cable made by our firm since 1907:

Name of Companies. Etc.	Location.	Miles of Single Circuit.	Voltage.	Year Built.
Hydro-Electric Transmission.	Western Ont.	450+	100,000	1908–1910
Winnipeg City	Manitoba	154	66 000	1908–1911
Mount Hood Railway & Power Co	Oregon	45	57,100	1910–1911
Mount Hood Railway & Power Co	Oregon	15	12,000	1910–1911
Calgary Power Co	Alberta	47	55,000	1909–1910
Calgary Power Co	Alberta	8	12,000	1909–1910
Electric Power Co	Central Ont.	300	44,000	1908–1911
British Canadian Power Co	Northern Ont.	48	44,000	1908–1910
Nipissing Power Co	Northern Ont.	22	22,000	1908–1910
Nelson City	Southern B. C.	10	12,000	1909
Approximate total mileage single circuit		1100		

These mileages are from memory, but are approximately correct, as also the fact that these lines have required about 3000 tons of cable.

The greater variation in sag due to temperature changes is only of importance where long spans are used; and wherever such spans are used it is, of course, necessary to give due consideration to the extra height and cost of towers for carrying aluminum cables. Experience shows, however, that stringing and tying are not more expensive for aluminum than for copper, but rather the reverse. I think that the more experience one has with aluminum cable the better satisfied one is to continue to use it.

C. B. SMITH,

Boise, Idaho. *Smith, Kerry & Chace.*

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Heat Tests of Dynamos.—S. P. Thompson.—An article referring to a criticism by Pohl that the usual specification of a six hours' run at full load to ascertain the full temperature rise, while more than sufficient for small machines, is not sufficient for large machines and transformers, the temperature of which continues to rise for more than six hours. In any case these long runs are tedious and expensive. It is, however, possible by a comparatively short run, not exceeding generally forty-five minutes, to obtain accurate information as to the final rise of temperature that would be reached in an indefinitely prolonged test. The method depends upon the principle that if the results of the test are plotted in a curve the abscissas of which are the time and the ordinates the rise of temperature above that of the surrounding air the form of the curve (an inverted logarithmic curve) is such that at every point the slope of the curve is proportional to the difference between the rise then attained and the final temperature rise. Fig. 1 gives such a curve of temperature rise. The slope of *OT*

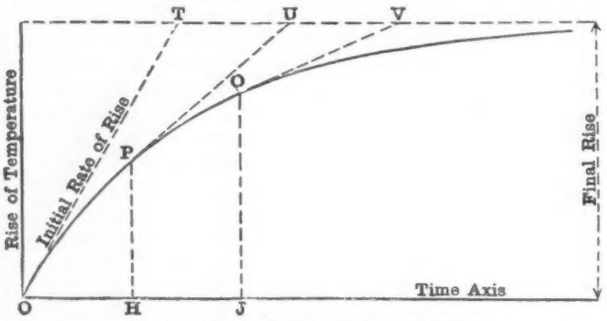


Fig. 1—Curve of Rise of Temperatures.

shows the initial rate of rise. At point *P* the height *PH* shows the state of things when the temperature rise has reached half its final value, and the slope here of the tangent *PU* is half the initial slope. The length of *OH* on the time scale is the time taken to attain this half rise. Point *Q* is placed where the rise has attained three-quarters of its final value, and the slope of the tangent *QV* at this point will be one-quarter of the initial point. Hence the method consists simply in first determining the initial rate of temperature rise and continuing observations until the point is reached at which the rate of rise has dropped to half its initial value; then the final rise will be exactly double the rise reached at that point. For example, if in a test the temperature rises at first at the rate of 1 deg. in two minutes, and if when the rate of rise has dropped to 1 deg. in four minutes the temperature rise is 14 deg., it is then known that the final rise will be 28 deg.—Lond. *Electrician,* Dec. 15.

Suppression of Sparking in Single-Phase Commutator Motors.—R. Richter.—A long paper illustrated by numerous diagrams. The author shows that all important types of single-phase commutator motors can be reduced to the series-repulsion motor, and a general formula for the "sparking voltage" of the motors is given. The author discusses the various methods of connections of the motors and especially his own method of inserting the exciting winding in the primary circuit of the starting transformer. He points out various advantages of this method over others.—*Elek. Zeit.*, Dec. 14 and 21.

Automatic Starting Device for Induction Motors.—N. Pensabene-Perez.—A paper read before the Birmingham section of the (British) Institution of Electrical Engineers. The author first sums up the principal advantages of an automatic self-starting induction motor provided with a suitable arrangement of a resistance with a great many steps and moving contacts controlled by centrifugal forces cutting out the resistances from the phases of the motor while the latter increases in speed at starting. He gives a formula showing how the resistance of the starter must vary in order to keep the rotor and, in consequence, the stator current constant during the starting period. The author describes a device of this kind which he has designed and which fulfils this condition and also describes a graphical method of calculating the time necessary for starting—Lond. *Electrician,* Dec. 22.

Constant Speed for Direct-Current Motors.—A note on a recent British patent (No. 10,342, Dec. 14, 1911) of Siemens Brothers Dynamo Works, Ltd. A speed sufficiently constant for practical purposes can be maintained by connecting an auxiliary machine in parallel with the motor to be controlled, through a field winding, which is in addition to the normal motor field winding. The field winding of the auxiliary machine is also connected across the motor terminals, so that should the voltage of the supply drop the field of the machine will weaken and a current will flow through the additional field winding, weaken the motor field and bring the speed up. The two machines can be either mechanically or electrically connected.—Lond. *Elec. Eng'ing,* Dec. 21.

Deposit from Transformer Oils.—H. D. Symons.—The first part of an illustrated article in which the author discusses the fact that many oils used for transformer insulation form a deposit in service. The reason for this must be found in the oils themselves and the author reports on various heating tests to determine whether an oil is liable to form a deposit. The article is to be continued.—Lond. *Elec. Review,* Dec. 22.

Lamps and Lighting.

Condensers for Metallic-Filament Lamps.—A communication referring to the article on Ashton's system abstracted in the *Digest* last week. The writer would hesitate to use the series system for street lighting because the failure of one lamp would mean the extinction of the others. He thinks the most suitable application is in the case of small series installations, the current-limiting effect of the condenser being especially valuable. He thinks it would be better not to put condensers in the switch wire, which is, or should be, the wire above earth potential, but to insert them in the return wire, which should be in connection with the supply company's earthed conductor; then, in the event of a fault to earth developing on the installation wiring, the fuse on the "live" pole would have an opportunity of blowing, whereas if the condenser were on the feed side of the fault it would allow a certain current to flow through the fault and the fuse would not blow.—Lond. *Electrician,* Dec. 15.

Condensers for Metallic-Filament Lamps.—A. W. Ashton.—A reply to the communication noticed in the preceding abstract. The objection to the series system, of all lamps going out when one fails, is easily overcome by the adoption of a cheap automatic short-circuiting switch, which would not require a substitutional resistance. The advantages of the condenser system are not only longer life due to a thicker filament and protection from "overshoot," but a higher efficiency can always be adopted for the lower voltage lamp, assuming the same percentage fall in candle-power. Putting this difference at the moderate figure of 0.1 watt per candle-power a saving of 72 kw-hours per year

is obtained for each 200-cp lamp. With regard to house lighting on the series system in the case of supply systems using an earthed return he points out that even with the maximum number of lamps switched on, provided the condenser is placed on the "live" side, the greatest stress to earth on the wiring would be 80 volts (root mean square). This, however, has not anything like the same "breaking-down" effect as the same pressure from a transformer. Owing to the presence of the condenser, the pressure falls immediately a current flows through a partial fault and a film of dirt is almost sufficient to prevent a short-circuit under these conditions. On the other hand, if such a fault should occur on the winding, it would be shown by the lamps between the faults and the earthed side failing to light up. Hence where cheaper types of wiring are adopted it is better to put the condenser on the "live" side; but where the wiring is designed for the full supply voltage the condenser may be put on the earthed side.—Lond. *Electrician,* Dec. 22.

Mercury-Arc Lamp.—R. A. HOUSTON.—In a continuation of his long illustrated serial on studies in light production the author gives a concise history of the mercury-arc lamp. —Lond. *Electrician,* Dec. 15.

Generation, Transmission and Distribution.

Peat for Fuel.—An illustrated article on a successful peat fuel plant in operation at a factory in Portadown, Ireland. The plant, which has a rating of 400 hp, consists of two 200-hp producers, with a coke scrubber, tar extractor, sawdust scrubber, exhauster and expansion box. The cost of the peat delivered on site at Portadown is $1.50 per ton, the amount of peat consumed per week with an average load on the plant of 275 hp being slightly under 20 tons at a cost of $30. From this must be deducted the value of the tar recovered from the plant, which averages $8.75 per week, leaving a net cost in fuel of $21.25. This plant is the only instance in the British Isles of the utilization of peat for power purposes.—Lond. *Elec. Review,* Dec. 22.

Installations, Systems and Appliances.

Booster Experiments.—L. SCHROEDER.—An account, illustrated by diagrams, of an extended series of experiments with the Pirani and Lancashire types of booster systems. First the principle of the Pirani system is explained and it is shown that this cannot be absolutely perfect because the voltage of a battery is not strictly constant while the current is constant, but changes, especially in the first seconds after the current has assumed a new value. The principle of the Lancashire system is then explained and it is shown to be a modification and improvement of the Pirani system. The results of the tests made with both systems and in which the load was suddenly changed by 50 kw or even 100 kw (the normal load being 50 kw) are then given in the form of oscillographic voltage and current curves, showing the small fluctuations of current and voltage with sudden large fluctuations of load. For traction service the Pirani system is quite satisfactory, and it is possible to connect the lighting system of the shops to the traction load, and even to do this with the lighting installation of the offices if the requirements for uniform illumination are not too stringent. The Lancashire system, on the other hand, gives such a uniform voltage that even the most stringent requirements can be fulfilled in practice; with the Lancashire system it is possible to connect the lighting system to the power-load circuits in any factory, even with greatly fluctuating load, without having to fear flicker of the lamps. It had been expected that the Lancashire booster would turn out to be less stable than the Pirani booster, but the tests showed that this was not the case. Further, it makes no difference whether the booster is operated with a special small exciter or not. All the machines in the tests were specially constructed with laminated field cores and with commutating poles. In the boosters not only the field cores but the yoke was laminated. The design was, therefore, such as to permit very quick and easy variations of magnetism.—*Elek. Zeit.,* Dec. 21; *Elek. u. Masch.* (Vienna), Dec. 24.

Wires, Wiring and Conduits.

Suspension Insulators.—W. WEICKER.—A long and profusely illustrated article in which the author discusses the three fundamental types of suspension insulators with respect to mechanical and electrical construction and also describes some recent designs of a German insulator factory.—*Elek. Zeit.,* Dec. 14 and 21.

Preservation of Telegraph Poles.—An illustrated article on the method of preserving telegraph poles by treatment with creosote.—Lond. *Elec. Review,* Dec. 22.

Electrophysics and Magnetism.

Emission of Electrons by Metals Under the Influence of Alpha Rays.—H. A. BUMSTEAD.—An account of an experimental investigation in which the author reaches the following conclusions: The emission of electrons by aluminum and gold foils under the influence of alpha rays (secondary delta rays) varies with the speed of the alpha rays in a manner entirely analogous to the variation in the gaseous ionization produced by alpha rays. The emission at first increases and then rapidly decreases as the alpha rays near the end of their range, and the curves obtained show all the characteristics of the ionization curves in gases. The curves lie within (to the left of) the corresponding curves for gases and have a less conspicuous "knee." So far they are in agreement with the known results on the retardation of alpha rays by metals and with the hypothesis that the loss of energy by the alpha particles is due to an ionization of the metallic molecules. But the close similarity in the behavior of gold and aluminum is not in accordance with this view. In view of the dissimilarity in the ionization curves of different gases, the agreement in the curves obtained for aluminum and gold is unexpected and leads to the suspicion that the observed effects may not be due to the metals themselves, but perhaps to a layer of absorbed gas in both cases.—*Phil. Mag.,* December.

Units, Measurements and Instruments.

Exhibition of Instruments.—An illustrated account of the recent exhibition of scientific apparatus of the Physical Society in London. An account is first given of a discourse held on this occasion by R. J. Strutt on electric discharge and the luminosity that survives it. Among the instruments exhibited were the Duddle oscillograph, the Paschen galvanometer, the Paschen thermopile, a cathetometer, a laboratory chronograph, a recording electrometer for meteorological investigations, a new modification of the Fery radiation pyrometer, rainfall recorders, portable apparatus for the analysis of the air of mines, a flux meter, the Crompton potentiometer, etc. The article is to be continued.—Lond. *Eng'ing,* Dec. 22.

Flux Meter.—At the recent exhibition of scientific apparatus of the Physical Society in London the flux meter by B. H. Morphy and U. A. Oschwald was shown for studying the flux distribution in the air-gap of a generator. It contains a flat exploring needle, which in experimenting on the pole-gap flux is held parallel to the armature, being attached to a radial arm which is carried by the armature shaft. The needle itself forms a mirror galvanometer. It consists of a slender shaft which is provided with needle-points at each end. A coil of twenty turns of very fine copper wire is wound longitudinally between two notches. Through silver filaments the ends of this coil are connected to terminals so that a weak current of about 0.03 amp can pass through it. The small shaft also carries a fine hair-

spring, which controls its deflection, and a small square brass block, on the four sides of which mirrors are mounted. The whole movement is held between brass bearings inside a brass tube, which has a width of ⅛ in., increasing to ⅝ in. in the portion which surrounds the mirrors and springs. Windows are cut in this wider portion of the tube, through which the light of a small osram lamp falls on the mirrors and is reflected on a scale. The lamp and the scale are supported by the radial arm already mentioned. In making a test the arm is moved through the gap and a current passed through the small coil, first in the one and then in the other direction. The apparatus brings out the flux variations near the armature teeth very well.—Lond. *Eng'ing*, Dec. 22.

Testing the Efficiency of Lightning Conductors.—Eric Wurm.—An illustrated paper in which the author describes a new apparatus for determining the resistance to earth of a lightning conductor, two auxiliary earth connections being used. The result is obtained directly from a single reading. The connections used for measuring the resistance of the earth connection R are shown in Fig. 2, and are similar to those used in the ordinary bridge measurement.

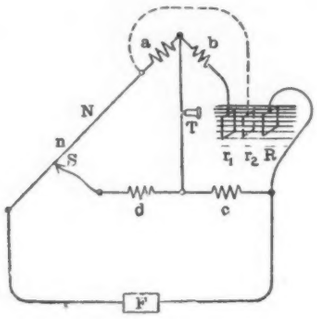


Fig. 2—Connections for Measuring the Resistance of the Earth Connection.

In measurements on earth plates alternating current must be employed, owing to the polarization that arises with direct current; therefore the telephone is used for indicating the neutral point. a, c and d are resistors of relatively high resistance, forming three arms of the bridge. The fourth arm also contains a high resistance b, together with the resistance R to be measured, as well as one of the auxiliary resistances r_1. The generator F is a small induction apparatus. The second auxiliary resistance r_2 is connected as a shunt to the first r_1 and the high resistances a and b. This enables one to take the greater part of the measuring current directly from R through the damp earth to the wire with the sliding contact. The measurement is, of course, made in the usual way by adjusting the position of the sliding contact S until the sound in the telephone reaches a minimum. The measurement given by the sliding contact S is proportional to the resistance of the earth connection R. By suitable division of the scale on the measuring wire this resistance can be read directly in ohms.—Lond. *Electrician*, Dec. 8.

Localization of Faults.—H. H. Jowers.—An article emphasizing the importance of simplicity of methods of localizing faults and describing methods and switchboard equipments for first determining the section of the network which is faulty and then localizing the exact point of the fault.—Lond. *Elec. Review*, Dec. 15.

Electrometer.—Jean Villeu.—A mathematical note on the electric torques in electrometers.—*La Revue Elec.*, Dec. 8.

Telegraphy, Telephony and Signals.

Submarine Cable Calculations.—R. Appleyard.—A note on a paper read before the (British) Institution of Civil Engineers on an instrument which he has devised, of the slide-rule type, for rapidly carrying out calculations in connection with submarine cables. In predetermining the speed of signaling through such cables and its dependence upon the cost, the principal term is log $(D \div d)$, in which D is the diameter of the dielectric and d is the effective diameter of the conductor. For any selecting value of log $(D \div d)$ there is an infinite number of pairs of values of D and d, and much labor is involved if many of these have to be calculated. For any selected values of D and d the instrument described gives log $(D \div d)$, the inductive capacity, the dielectric resistance, the conductor resistance, the self-inductance of an "unloaded" loop, the weight of the conductor, and approximately the weight of the dielectric per unit length of cable. The instrument is circular and depends upon the use of a logarithmic spiral, the pole of which is at the center of the circle. This circle is divided into degrees, and the radial arms can be set to any required angle. One arm is allotted to D and the other to d. The accuracy of the instrument is increased by the use of a secondary spiral, and by this means an accuracy of 0.5 per cent is attained for the range that would be used in practice.—Lond. *Electrician*, Dec. 15.

Interference Between Energy Transmission Lines and Telegraph and Telephone Lines.—Karl Hohage.—The author first discusses the principles of interference due to electromagnetic induction and to electrostatic induction, the latter being the prevailing cause of trouble in practice. He gives some general rules on wiring of telegraph and telephone lines and connecting the apparatus and then takes up ways and means of protecting people against accidents which would arise from a contact of a telephone line with an energy-transmission line. The article is to be concluded.—*Elek. Zeit.*, Dec. 21.

Wireless Telegraphy.—S. M. Powell.—A fully illustrated article in which the author first discusses syntony and its limitations and then directive wireless telegraphy, dealing with the system of Fleming and Marconi, the interference methods of Brown and Blondel, the Bellini and Tosi directive aerials, and the same inventors' radiogoniometer. The latter instrument enables the emission of variously directed variations from a fixed aerial. Two identical aerial frames are arranged perpendicularly to each other. On exciting both simultaneously a resultant asymmetric radiation of energy is obtained, which has a maximum in a direction dependent on the relative excitation of the two circuits. The value of this instrument for use on board ship is discussed, and results of practical tests of it in navigation are given.—Lond. *Elec. Review*, Dec. 15.

Wireless Telegraphy.—W. H. Eccles.—The first part of an article reviewing wireless-telegraph patents issued during the past year. In the present instalment the author deals with various sending apparatus.—Lond. *Electrician*, Dec. 22.

Book Review.

An Elementary Introduction to the Experimental Study of Frictional Electricity. By K. H. Reichau, Ph.D. New York: The Maset Company. 111 pages, illus. Price, $1.

A very practical experimental series of studies and tests in frictional electricity. About sixty experiments are stated and described as capable of being carried out with a not very expensive set of laboratory apparatus prepared specially for this purpose. Simple deductions are made from these experiments in turn. No mathematics is used, not even arithmetic, so that all the tests made are qualitative. Nevertheless, much practical knowledge concerning frictional electricity can be obtained by working out the series of experiments, which are well within the scope of a boy or girl in high school. The book will be of interest to schools giving courses in elementary physics, and also to individual young aspirants to the science of electricity.

New Apparatus and Appliances

AUTOMATIC SERIES CUT-OUT.

The occurrence of an open circuit on a series-arc street-lighting line not only extinguishes all the lamps on the circuit, but may endanger the lives of the public if the high-tension wires fall into the street. An automatic cut-off for disconnecting the portion of the line in trouble, meanwhile permitting the continued operation of the remaining lamps of the circuit, is marketed by the Shedd Electric Company, of Roselle Park, N. J. The cut-off, which is shown in the accompanying diagram, is intended for installation at the points of departure of various branch loops, as well as for use at intervals along extended circuits such as the lighting of long avenues.

At the top of the sketch is shown the loop to be protected by the cut-out, the other lamps in circuit and the source of energy being represented below. A break in the upper loop will momentarily impress the total voltage of the source across the graduated spark-gap. The potential bridges this gap, its circuit being completed through the winding of the switch solenoid at the top. This solenoid, by lifting the switch part, breaks the connections to the loop, removing from it all potential. Meanwhile the spark-gap is positively bridged by the contact in its upper position, the circuit continuing through the solenoid winding, which acts as a holding coil. To release the switch after the

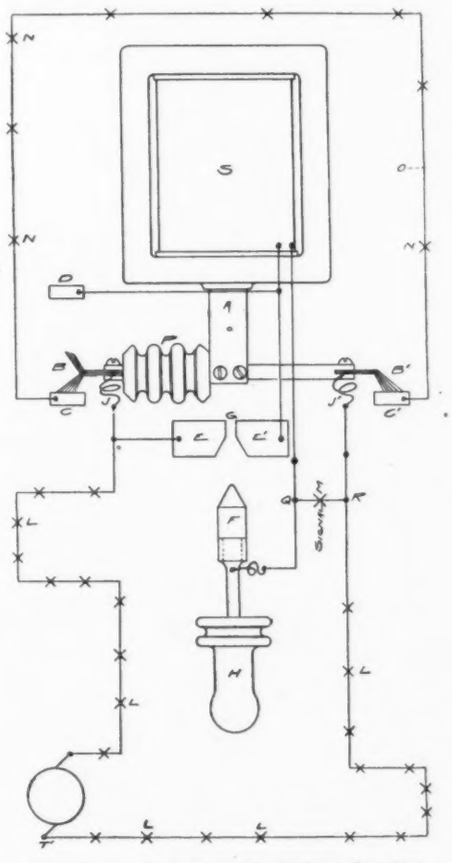


Diagram of Automatic Series Cut-Out.

trouble has been cleared, the spark-gap is short-circuited with the insulated tool shown, thereby de-energizing the coil and allowing the switch to fall back into operative position. A signal lamp in circuit between the spark-gap and the right-hand lead shows by lighting up when the cut-off has operated. Normally the cut-off, of course, consumes no energy. The presence of several such devices on a given circuit will simplify line construction, avoid returning loops to the station and serve to localize troubles. The cut-offs are adapted for operation on direct-current or alternating-current circuits and with series generator, transformer or rectifier sources of energy.

ELECTROSTATIC VOLTMETER.

The operation of the voltmeter illustrated herewith is based on the attraction existing between two electrodes separated by a dielectric. One of the electrodes is stationary and consists of tinfoil arranged on the outside of the bottom of the vessel containing oil as the dielectric. The other electrode consists of a cup with round edges suspended from a metal strip so as to swim in the oil.

Owing to the attraction of the electrodes, when subjected to the voltage to be measured, a pull is exerted on the strip and communicated mechanically to a pointer playing over a scale. The mechanical arrangement is such that for voltages from 30 per cent of the maximum upward the scale divisions are nearly uniform.

An essential part of the instrument is the arrangement employed for protection against external fields. The oil vessel is placed in a tub with round edges surrounding the vessel to about one-half its height. The cup swimming in the oil, which forms the upper electrode, is surrounded by a bell with round edges, which is conductively connected with the casing of the system. The edges of the tub and the protecting bell are mounted at almost the same height.

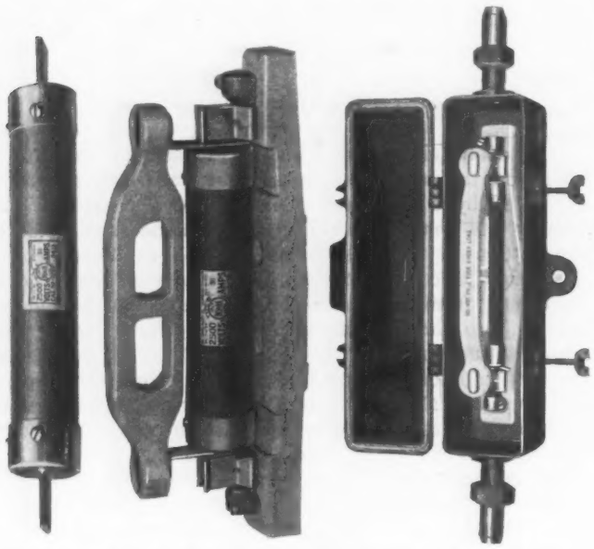
Electrostatic Voltmeter.

By this means a distortion of the field in which the moving electrode is arranged cannot be produced by any excess charges in the neighborhood of the instrument.

The above-described instrument as built for measuring emfs up to 150,000 volts has been placed on the market by the Siemens & Halske A. G., Berlin, Germany.

2500-VOLT PRIMARY FUSES AND FUSE BOXES.

After a study of the prevailing conditions and exhaustive tests on many of the largest aerial and underground systems in the country, the Johns-Manville Company has brought out a line of single-pole primary boxes and 2500-volt fuses which are designed with ample factors of safety not only to meet the most stringent conditions of to-day,



Figs. 1, 2 and 3—Fuse, Fuse Handle Carrier and Fuse Box.

but to provide adequate protection under the increased severity which may be predicted for the years to come. These boxes are made in three sizes, having maximum capacities of 30 amp, 60 amp and 100 amp. A complete line of fuses is made for each size for currents ranging from the maximum down to ½ amp. This feature relieves the central-station man or superintendent of distribution of the burden of replacing his fuse boxes with others of larger capacity as the load on his system increases, it being only necessary to estimate the maximum current that will ever be required at a particular installation, purchase the corresponding box and fuse it down to the proper point. As the load increases from time to time it will, therefore, only be necessary for him to change the fuses.

For aerial lines these boxes are provided with porcelain bushings of very liberal dimensions giving mechanical strength and abundant leakage surface. These bushings are located either on one side of the box or at the top and bottom, according to a consumer's system of connection. Several styles of feet or fastening lugs are offered, as it has been found that ideas vary in this respect. For subway installation these boxes are provided with unions on the outlets, located either at the ends or on the side.

The union is very simple, consisting of but three parts—

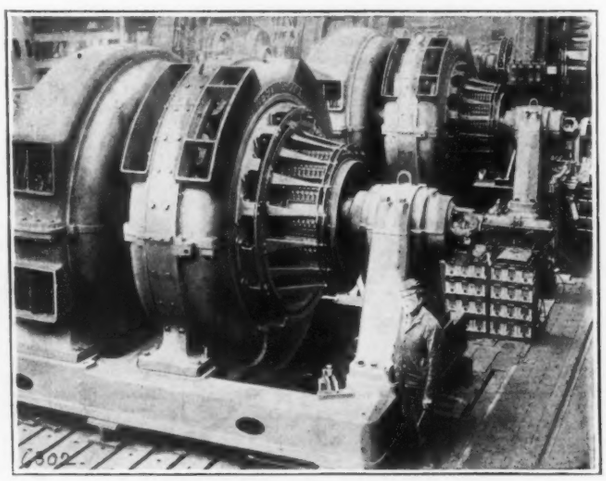
Fig. 4—Single-Pole, 2500-Volt, Fuse Box.

a brass cable sleeve tinned to facilitate wiping a joint to the lead sheath of the cable, a male end screwing into the cast-iron box with a standard pipe thread, and a hexagonal nut or shell. The joint between the male end and the cable sleeve is ground to a perfect fit, thereby securing absolute water-tight properties without the use of a gasket of any form. All "Noark" primary boxes, whether for aerial or subway work, are equipped with doors hinged at the side and held closed by pivot studs and wing nuts against a tubular rubber gasket of high resiliency.

Aside from the accuracy of the fuse and its ability to open the circuit quietly under all conditions, the two most important requirements of a primary fuse box are dielectric strength (between live metal parts and the iron) and safety to the operator. "Noark" primary fuse boxes depend for their dielectric strength upon dry-process glazed porcelain, whose excellence as an insulator is too well known to require discussion, and upon air space which possesses the distinct advantage over all insulating compounds that it is not subject to deterioration in any form and cannot vary. The fuse is mounted in a porcelain carrier handle which provides absolute safety to the operator in its insertion and removal, as it allows him to manipulate the fuse without bringing his hand in proximity to any live metal or grounded parts. Each "Noark" primary fuse box is tested before shipment at a potential of 10,000 volts (or four times the operating voltage) between live metal parts and the iron case.

LARGE MACHINES UNDER CONSTRUCTION.

An example of the activity at the Westinghouse shops in building large machines is given in the view herewith, which was taken in one of the main aisles in the East Pittsburgh works, showing some unusually large and interesting machines now being built. In the foreground are seen two motor-generator sets of particular interest. These sets are each of 1500-kw rating and consist of a 2250-hp, 12,000-volt, three-phase, 60-cycle synchronous motor, direct-connected to and mounted on a common iron base with a 1500-kw, 250-volt direct-current generator. These sets are for installation in a substation of the Cosmopolitan Construction Company, located in the basement of a department store in Chicago. The openings shown in the frame are for the attachment of conduits which will conduct the heat from the machines to the outside of the building. This scheme of inclosure and ducts also serves to conduct the noise away from the building.



Large Motor-Generators Under Construction.

To the left and rear of the synchronous motor-generator sets is a 4000-kw rotary converter, recently shipped to the Interborough Rapid Transit Company, of New York, which is capable of handling a maximum swing of 8000 kw. This machine is equipped with commutating poles, and it is the largest rotary converter ever built. It will be of particular

service in furnishing excess energy called for by the acceleration of the ten-car subway express trains.

To the right and rear of the motor-generator sets are shown some 3000-kw rotary converters built for the Chicago Railways Company and the Philadelphia Rapid Transit Company. These machines clearly indicate the tendency of the operating companies toward the larger units.

In the immediate vicinity, but obscured from the view by the other machines in this aisle, are two 12,500-kw, 6600-volt, 50-cycle, 300-r.p.m. vertical water-wheel generators being built for the Rio de Janeiro (Brazil) Tramway, Light & Power Company, which are among the largest machines of this kind that have ever been made.

ELECTRICALLY DRIVEN MILL OF THE KING PAPER COMPANY, KALAMAZOO, MICH.

By R. S. FLESHIEM.

The saving in power, flexibility of operation and freedom from shafting, pulley and belt troubles resulting from the installation of motor drive in paper mills have been so thoroughly demonstrated in actual practice that the older methods of drive are rapidly becoming a thing of the past. A recent and noteworthy example of the use of motors in paper-mill work is the installation of the King Paper Company, of Kalamazoo, Mich. This company manufactures super-calendered and extra-machine-finished book, map, lithograph, plate and folder paper, as well as coated book and lithograph paper. Within the past eighteen months the capacity of the mill has been doubled by the addition of two paper machines and the accompanying auxiliary apparatus. The new mill is entirely equipped with electric drive, the same system being partly extended to the older mill with the object of cutting down the cost of power.

In determining the type of motors to be installed it was found after careful investigation that on account of the large number of machines, in addition to the paper machines themselves, where a certain amount of speed variation is desirable direct-current motors would prove the most satisfactory.

The mill is located near the Kalamazoo River, which furnishes an ample quantity of water for both power and manufacturing purposes.

A traveling crane extends over the coal-storage bunkers. This crane, furnished by the Northern Engineering Works, Detroit, is electrically operated and has a clam-shell bucket for handling both coal and ashes. The crane tracks run directly into the boiler-room and drop the coal into bunkers over the stokers. A weighing device is arranged so that the coal used each day can be accurately recorded. The boiler house contains twelve Wickes vertical water-tube boilers, six having a capacity of 300 hp and the other six 200 hp each. The larger boilers are equipped with stokers built by the Detroit Stoker Company, while the Murphy Iron Works of Detroit furnished the stokers for the smaller unit. The ashes and clinkers are dumped by hand into a pit just outside of the boiler-room, from which they are delivered onto flat cars by the crane already mentioned. Feed water is supplied by pumps furnished by the Union Steam Pump Company, of Battle Creek, Mich., one of these being motor-driven and the other steam-driven. The motor-driven pump is located in the basement of the engine-room, but is controlled by a speed regulator in the boiler-room.

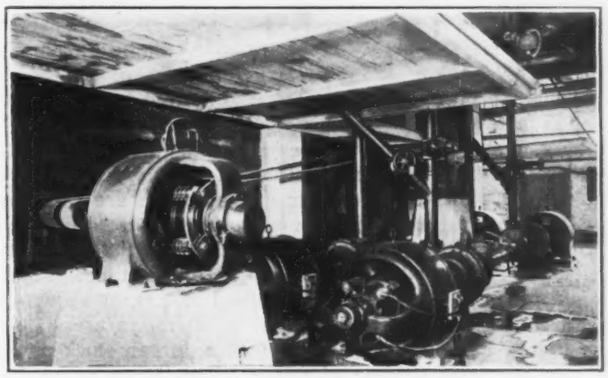


Fig. 2—Motor-Driven Stuff Chest.

The principal generating units comprise one 1000-kw, 95-r.p.m., 240-volt engine-type direct-current generator, driven by a 26-in. and 56-in. by 48-in. cross-compound heavy-duty Corliss engine, and one 250-kw, 375-r.p.m. three-bearing generator belted to a 13-in. and 24-in. by 42-in. tandem-compound Corliss engine. The large generator operates twenty-four hours a day, six days a week, and carries 25 per cent overload for hours at a time without any signs of heating or commutator trouble.

Rags are carried from the three lower storage floors to the top floor of the warehouse by elevators, and in the first room of the rag department are sorted by hand. They are then threshed by machinery and assorted, at which time any objectionable materials such as buttons, rubber, etc., are removed. The rag cutters next receive the material, and, after being thoroughly cut up, it is carried by a belt conveyor to railroad dusters and fan dusters. The cutter, fan duster and thresher are driven by one 25-hp constant-speed motor. For removing dust from the rag rooms and keeping the air pure there is a motor-driven fan of the American Blower type.

From this department the rags are taken to the "rotary" room, where they are placed in a rotary bleach boiler and cooked for ten hours in lime and soda ash. The lime destroys any wool that may have escaped the sorting de-

Fig. 1—Adjustable-Speed Motor-Driven Beaters.

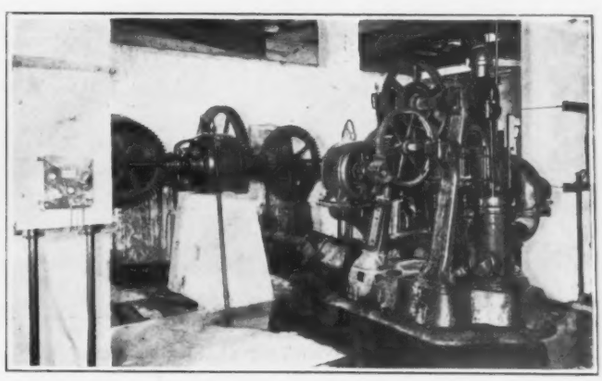


Fig. 3—Motor-Driving Clay-Chest Agitators and Stock Pump.

partment, and the soda ash cuts the grease. This rotary bleach boiler, which was manufactured by the Holyoke Steam Boiler Works, is driven through gears by a 5-hp constant-speed motor. From the bleach boiler the rags are taken to 1000-lb. washers built by J. H. Horne & Sons, where, after washing and grinding, they are bleached by chloride of lime and sulphuric acid and then dropped into drainers in the beater-room basement.

From the drainers the rags are taken in carts to the floor above and placed in 1200-lb. beaters, together with soda and sulphate pulp. Here are added alum to make the paper hold color, and also sizing to prevent ink going through in printing. Here, too, the desired coloring matter is mixed in.

Fig. 1 shows two of the beaters, with their motors and control panels. These motors have a speed variation from 325 to 415 r.p.m. by field control. The panels are arranged with recording ammeters showing the load at any time. The stock is next drained into stuff chests in the basement, where it is agitated slowly to keep it from settling. These agitators are driven by constant-speed motors, as shown in Fig. 2. Motors geared to clay-chest agitators are shown in Fig. 3, in which can also be seen a Jordan stock pump driven by a constant-speed motor. This latter pump delivers stock from the agitators to the Horne-Jordan engines on the floor above, where it is refined to proper length of fiber. These Jordan engines are connected by means of flexible couplings to 125-hp motors having a speed range of 450 to 500 r.p.m. The method of drive is a new one, and can be readily understood from Fig. 4. The flexible couplings between the motors and the Jordan machines have long pins fastened at one end only, and around these pins is threaded a leather belt. As the Jordan plug wears and it becomes necessary to change its position, this coupling permits the drawing in of the plug without disturbing either motor or machine. The method has been found more satisfactory than the former practice of moving the heavy motors. The control panels are equipped with Cutler-Hammer multiple-switch starters, field rheostats for speed variation, and recording ammeters.

From the Jordan engines the stock is pumped to stuff chests in the machine-room basement and from there to the paper machines proper. Two machines of the Fourdrinier type are installed in the new mill, one a 142-in. Beloit machine, and the other a 124-in. Horne machine. The constant-speed shafts of the paper machines are driven by 40-hp constant-speed motors, and from each shaft are

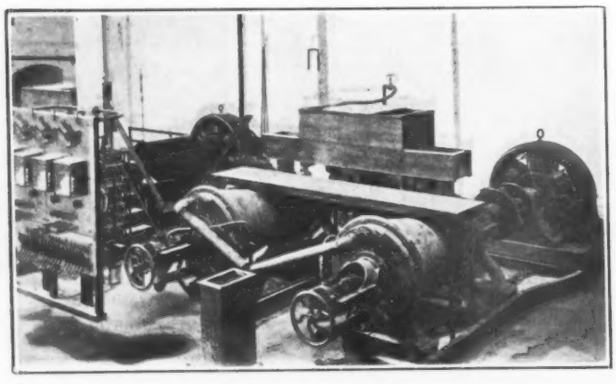


Fig. 4—Jordan Engines Driven Through Flexible Couplings.

driven a stuff pump, screens, centrifugal pump for back water, suction pump and shake.

The variable-speed shafts are driven by 100-hp adjustable-speed motors running at 107 to 750 r.p.m., giving a range of paper speed from 36.5 ft. to 255 ft. per minute. Each motor is fed by a motor-generator set consisting of a 75-kw, 250-volt generator, driven by a 230-volt shunt-wound motor, the generator voltage being varied for speed control of its motor.

In the finishing room are six super-calenders ranging in size from 40 in. to 74 in. These calenders put a smooth finish on the paper, and each is driven by two motors. A small constant-speed motor is used for starting the rolls

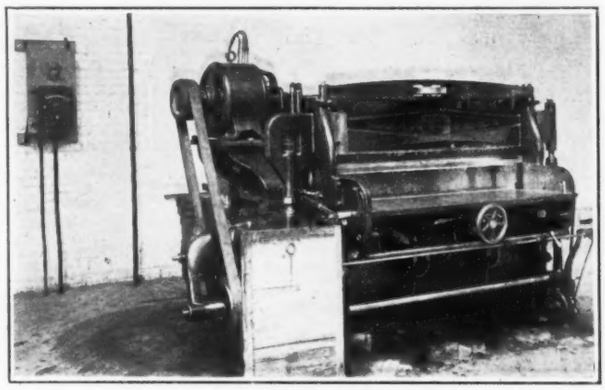


Fig. 5—Motor-Driven Paper Cutter.

at slow speed in order to permit threading in the paper. Larger adjustable-speed motors of from 50 hp to 75 hp rating drive the calenders after they are ready for operation. These motors have a speed variation of approximately 25 per cent.

Paper cutters furnished by the Hamblet Machine Company, of Lawrence, Mass., and driven from a line shaft in the basement, are used to cut the paper into the sizes desired by the trade. This line shaft is driven by a constant-speed motor. Fig. 5 shows a separate motor-driven Seybold paper cutter.

In the coating plant each of the coating machines, which were built by John Waldron & Company, of New Brunswick, N. J., is driven by a 15-hp adjustable-speed belted motor, running at 450 to 580 r.p.m.

In this same department are the cotton calender rolls. The method of drive of these calenders is the same as that described for the super-calenders in the preceding paragraphs.

There is a machine shop containing saws, knife-grinders, lathes, planers, pipe-cutters, etc., all driven from one constant-speed motor. Since the service on these machine tools is of a very intermittent nature, only a 30-hp motor is required to drive them.

To keep the dust cleaned out of the motors a portable pneumatic set is used. This consists of a motor-driven air compressor, an automatic governor, an air gage, a storage tank, fuses and switch, as well as the necessary piping, all securely mounted on a serviceable truck. This compressor has a capacity of 20 cu. ft. per minute and operates on the 220-volt direct-current circuit. The governor automatically cuts out the motor when the air pressure has reached a maximum of 75 lb. per square inch, and starts the motor again when the pressure has fallen to 60 lb. per square inch. A hose is attached to the tank opening, and with this all parts of the motors can be reached as the outfit is pulled about from place to place.

The Kalamazoo mill was built under the direction of Mr. A. L. Pratt, president and manager, and Mr. John F. King, vice-president and superintendent. The electrical engineering, including installation of motors, generators, switchboard, conduits, wiring, etc., was done by the Lounsbery Brothers Company, of Chicago. Mr. Dan J. Albertson, of Kalamazoo, was retained as architect and mechanical engineer, the buildings, boiler house and engine-room having been erected under his supervision. Practically all of the electrical equipment was furnished by the Allis-Chalmers Company.

Industrial and Commercial News

CONDITIONS in the majority of industries have undergone moderate improvement since the beginning of the new year. A slight increase has taken place in the volume of business transacted, and decided improvement is being shown in the attitude toward new commitments. A convincing proof of the industrial advancement at the close of 1911 is shown in the report issued Jan. 10 giving the unfilled orders on the books of the United States Steel Corporation on Dec. 31. This placed the unfilled tonnage on that date at 5,084,761 tons, as compared with 4,141,955 tons on Nov. 30, an increase of nearly 1,000,000 tons, and was the highest figure since that of March 31, 1910, when 5,402,514 tons were shown on the books. Substantial orders for steel rails are now pending. Orders for pig-iron, while numerous, are chiefly in small amounts. Business on the New York Stock Exchange and throughout the financial district has been greatly hampered during the week by traffic congestion resulting from the destruction of the Equitable Life Assurance Society's building by fire, Jan. 9, and by inability to obtain the mass of securities in its vaults. Rates in the money market, Jan. 10, were: Call, 2@2½ per cent; ninety days, 3¼@3½ per cent.

THE COPPER MARKET.

The December statement of the Copper Producers' Association, issued in the early part of the week, placed stocks of marketable copper in the United States on Jan. 1, 1912, at 89,454,695 lb., which compares with the 111,785,188 lb. on hand Dec. 1—a decrease of 22,330,493 lb. Production in December was 122,896,697 lb., as compared with 111,876,601 lb. in November, and total deliveries were 145,227,190 lb., comparing with 135,089,055 lb. in the preceding month. Domestic deliveries were 65,988,474 lb., against 68,039,776 lb. in November, a decrease of 2,051,302 lb. Exports were given in the report as 79,238,716 lb., as compared with 67,049,279 lb. in November. The custom house statement shows that, in addition to the 37,430 tons of copper shipped in December from Atlantic ports, 295 tons was shipped from Southern and Pacific ports during the month, making a total of 37,725 tons, the largest export tonnage on record. Business has been quiet during the week, and quotations for electrolytic have averaged 14½ cents per pound, delivered, thirty days. Exports for the month, including Jan. 10, aggregate 7332 tons. The daily call on the Metal Exchange Jan. 10 quoted copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	13.75	14.12½	....
January	13.92½	14.12½	14.00
February	13.95	14.15	14.05
March	13.95	14.20	14.07½
April	13.95	14.25	14.10

The London market, Jan. 10, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	63 5 0	63 0 0
Standard copper, futures	64 0 0	63 15 0

Extreme fluctuations in 1912:

	Highest.	Lowest.
Standard	14.00c	13.57½c
London, spot	£64 5 0	£62 15 0
London, futures	65 0 0	63 11 3
Best selected	68 5 0	67 15 0

INDUSTRIAL AND COMMERCIAL NOTES.

The Diesel Engine.—A rumor to the effect that an electrical manufacturing company will manufacture the Diesel engine in the United States was emphatically denied this week by August A. Busch, vice-president of the Busch-Sulzer Brothers-Diesel Engine Company, of St. Louis. Vice-president Busch said to a representative of the *Electrical World*: "I cannot understand how such a report started. My father, Adolphus Busch, president of the Busch-Sulzer Brothers-Diesel Engine Company, bought the American and Canadian rights in 1898, I think it was—at least several years ago. We have as full partners in the business the only owners of the patents in Europe and the patentee. We have the patents now in our possession in this country and we are going right ahead as soon as our plant is built to make the engines, for we are the only company in this country legally entitled to do so. The plant referred to will be built on a site on the South Side of St. Louis, and work on the foundations will be begun as soon as some tenement houses now partly occupying the grounds are torn down, which will be done during the present month. The plant will consist of office buildings, power house, several machine shops, a main and smaller foundries, blacksmith shops and a testing shop. The buildings and equipment will initially cost $500,000, but it is intended to enlarge the plant to double its first capacity as soon as it is in operation. About 700 workmen will be employed at the start. St. Louis was selected after several offers had been received from other cities, among which were Detroit, Mich., and Dayton, Ohio, the Commercial Club of the latter city having offered a free site and other inducements. An account in detail is given in the *Electrical World* of Feb. 2, 1911, of the organization of the present Diesel company, which succeeded the American Diesel Engine Company.

Georgia Railway & Power Company's Capitalization Approved.—The Georgia Railroad Commission has authorized the Georgia Railway & Power Company to issue $30,000,000 in bonds and $27,000,000 in stock, the amount asked for when the company was organized last September, as previously stated in these columns. The stock will be divided into $15,000,000 common, $2,000,000 first preferred and $10,000,000 second preferred. According to statements of J. J. Spalding, of Atlanta, Ga., one of the directors, the company will proceed immediately with the development of water-power resources in northeast Georgia, will accelerate work upon the 60,000-hp development at Tallulah Falls in the hope of furnishing energy to Atlanta from this station in July, 1912, and will also undertake the construction of an interurban electric road from Atlanta to Stone Mountain as soon as possible. In addition to leasing the Georgia Railway & Electric Company the new company plans to merge the Georgia Power Company, the South Carolina Power Company, the Atlantic Hydroelectric Company and the Atlantic Water & Electric Power Company.

The McKinley System.—The Illinois Traction System and its associate company, the Western Railways & Light Company, while very prominent in the street-railway and interurban field of the Central West, operate also a large number of electric-service and other public-utility plants in Illinois, Iowa and Kansas. These two companies control electric-service utilities in Danville, Champaign, Decatur, Jacksonville, Bloomington, Urbana, Edwardsville, Madison, Venice, Granite City, Galesburg, Cairo and Ottawa, Ill., and also in Topeka, La Salle and Atchison, Kan., and Des Moines, Ia. At Marseilles, Ill., the McKinley interests are just completing a low-head hydroelectric generating plant utilizing the flow of the Illinois River at that point. Hon. William B. McKinley, of Champaign, Ill., a representative in Congress, is the president of the Illinois Traction System and the Western Railways & Light Company, and H. E. Chubbuck, of Peoria, Ill., is the vice-president-executive.

Commonwealth Edison's New Building.—Finding its present building at 120 West Adams Street, Chicago, inadequate for its main-office business, the limited space requiring sheltering of several departments in adjacent buildings, the Commonwealth Edison Company, of Chicago, has purchased the twenty-story office building of the Continental and Commercial Bank, at the northeast corner of Clark and Adams Streets. It is probable that other public-utility companies will have their headquarters in the building. It is stated that the Commonwealth Edison Company acquires the building, which is valued at $5,000,000, through the purchase of the $2,860,000 capital stock of the Commercial National Bank Safe Deposit Company, which owns the building.

Denies Existence of Cable Rate War.—Theodore N. Vail, president of the Western Union Telegraph Company, has issued a statement in which he says that all talk of a telegraph or cable war of cut rates is absurd, that the day of destructive competition is past, and that no rate war will take place if the Western Union can help it. Competition, he said, should be aggressive but constructive, and must be along legitimate and profitable lines. "The whole business of electrical transmission of intelligence," he said in part, "has been built up on the one idea of expedition. Expedition has been the essence of 90 per cent of the telegraph and cable business. Expedition in intercommunication is an ever-growing necessity. Expedition, however, is costly. Business is confined to a few hours of the day and has rush periods in those hours. Expedition, therefore, results in idle facilities which we intend to utilize." He added that since the institution of the lower rates for deferred cable and telegraph service, previously mentioned in these columns, the business on the higher rates for quick service has increased instead of falling off. There has been an increase in operating expenses, but this has been offset by the greater revenue. The January number of the *Postal Telegraph*, issued by the Postal Telegraph-Commercial Cable Company, takes a somewhat belligerent attitude toward the question of competition on the part of its rival. It contains, among other comments, the following: "When the Bell interests acquire an Independent telephone company rates are advanced, there being a monopoly. When the Bell interests acquire telegraph and cable properties rates are reduced, there still being competition. 'How long, O Catiline! will you abuse our patience?'" Government investigation of the Bell Telephone operations in Chicago was begun on Jan. 9, and this investigation is thought to be the forerunner of a nation-wide investigation of the attempts of the Bell interests to buy all the important independent telephone companies in the country.

Car-Wheel Factory's 1000-kw Generating Plant Replaced by Central-Station Service.—The Griffin Wheel Company, of Chicago, makes car wheels, and one of its plants is at Pullman. This is a modern manufacturing establishment, electrically equipped, with about 1200 hp in three-phase, 440-volt motors driving various types of machinery, and the equivalent of about 2000 16-cp lamps in lighting equipment. Electricity has been generated on the premises by a modern turbo-generator plant erected about four years ago, with superheaters and the latest types of steam and electric power-plant apparatus. It is an interesting fact that this comparatively new plant has just been superseded by the electric service of the Commonwealth Edison Company. The Griffin Wheel Company has sold its power-plant machinery to the central-station company and will rely on the latter entirely for electrical energy to operate this factory. After careful figuring with the power engineers of the Commonwealth company, the wheel manufacturers became convinced that they could buy electrical energy more cheaply than they could make it.

Foreign Competition for Large Pipe Contract.—J. G. White & Company, Incorporated, of New York and San Francisco, have just purchased 124 miles of 12-in. steel pipe to be used by them in building a natural-gas line for the Midway Gas Company in California. The pipe will weigh approximately 11,000 tons and with transportation will cost approximately $600,000. Quotations were asked from British, German and French manufacturers, and the best foreign price was that of a British firm, which, exclusive of duty and freight, was approximately double that at which the contract was placed with the National Tube Company, a subsidiary of the United States Steel Corporation. This indicates the remarkable resources of the United States for cheap production of steel and the advantages of buying this kind of manufactured material in the American market.

Another Plant in the Auglaize River.—Interests allied with the Auglaize Power Company, which expects to place its new 5000-kw hydroelectric plant on the Auglaize River, near Defiance, Ohio, in operation toward the end of February, are planning the erection of a second hydroelectric plant of approximately 4000-kw capacity on the Auglaize River to meet the growing demand for energy in that section. R. R. Livingston, of 2 Rector Street, New York City, chief engineer of the Auglaize company and designer of its station, expects to start preliminary work on the new plant very shortly, and hopes to have it in operation before the end of December, 1912. Mr. Livingston will design the hydroelectric plant which President Ashley and others of the Auglaize company are planning to erect upon the Ohio River, near Letart Falls, as mentioned in these columns Dec. 16, 1911.

General Electric Will Furnish Panama's Electric Towing Locomotives.—A contract has been awarded to the General Electric Company for one of the forty electric locomotives for towing ships through the Panama Canal, described in the *Electrical World* Sept. 30 and Oct. 21, 1911, together with a provisional award for the other thirty-nine locomotives if the first proves satisfactory. There were five bidders for the forty machines. The highest bid was $827,395.95, and the lowest, the General Electric bid, was $498,016.35. The award was made on the regular bid in which carbon steel was specified, the optional bid calling for vanadium steel. The first locomotive is to be delivered on the Isthmus within 260 days from date of award of the contract.

Telephone Manufacturing Plant for Fort Dodge, Ia.—The Monarch Telephone Company, of Iowa, as an outcome of reorganization of the Monarch Telephone Company, of Chicago, has filed incorporation papers with a capital of $150,000, and will locate a plant at Fort Dodge, Ia., for the manufacture of all classes of telephone equipment. The officers of the company are O. M. Oleson, of Fort Dodge, president; J. C. Hubacher, of Chicago, vice-president; W. H. Trimm, of Chicago, secretary, and T. H. Wright, of Fort Dodge, treasurer.

Philippines Electrical Plant.—J. E. Stevens, consulting electrical engineer, Manila, P. I., is figuring on installing an electric light and power plant of considerable size in the Philippine islands, to be operated by crude-oil engines and water turbines and wishes to receive data and prices on power-plant apparatus of these types, as well as of electrical material.

Financial.

Puget Sound Utility Consolidation.—A consolidation of all the principal public-utility properties controlled by Stone & Webster in the Puget Sound district is announced at Boston. The new company will be known as the Puget Sound Traction, Light & Power Company, and will take over the properties and assets of the Pacific Coast Power Company, Seattle Electric Company, Seattle-Tacoma Power Company, Puget Sound Electric Railway and Whatcom County Railway & Light Company. Until the consolidation is completely effected this company will acquire a controlling interest in all or a part of the above organizations. The new company will offer to exchange its own stock for the preferred and common stocks of the Pacific Coast Power Company, Seattle Electric Company, Puget Sound Electric Railway and Whatcom County Railway & Light Company, and will offer to purchase the property and assets of the Seattle-Tacoma Power Company. It is also proposed to have the new company offer to exchange its own stock for the preferred stock of the Seattle-Tacoma Power Company. The initial authorized capital stock of the new company will be $15,000,000 6 per cent cumulative preferred stock and $25,000,000 common stock, of which the amount required for exchange, if all the above stocks are exchanged on the basis provided in the plan, will be $11,100,967 preferred stock and $20,328,110 common stock, thus leaving a balance of $3,899,033 preferred and $4,671,890 common stock authorized but not issued. It is estimated that earnings of the new company in 1912 will enable it to pay 6 per cent on the preferred stock and 4 per cent on the common stock after paying all taxes, providing for interest charges and sinking funds and allowing liberally for maintenance and depreciation. It is estimated also that not over $8,000,000 will be required during 1912, in part for the purchase of the properties above referred to, in part to retire certain underlying indebtedness and in part for extensions and improvements. To meet these requirements the new company may issue and dispose of such parts of its

authorized capital stock as may not be required for the exchanges and may issue and dispose of its own bonds and other obligations. In this plan full consideration has been given to the physical and financial conditions of the properties and to future possibilties. The plan meets with the unanimous approval of the boards of trustees and directors of all the companies included. To carry out properly and effectively the plan, if it meets the approval of the stockholders, a general committee of five has been appointed, one member being selected from among the stockholders of each of the companies. This committee consists of Thomas A. Perkins, of Ropes, Gray & Gorham; Albert W. Harris, of N. W. Harris & Company; George C. Lee, of Lee, Higginson & Company; Philip Stockton, president Old Colony Trust Company, and Harry K. White, all of Boston. This committee will receive from stockholders their assents to the plan and their agreements to transfer to the new company their stocks in the present companies on the basis of exchange provided for. It is contended that a single company serving the Puget Sound district will be able to save much duplication of investment which would necessarily occur if the companies remained separate. Material savings are also anticipated in operating accounts and in the financing of the single larger company. The rapid development of the Puget Sound country is indicated by the growth of the Seattle system alone. In 1900, the first year of operation, the gross earnings were $1,094,000; in 1910 they had increased to $5,588,900. Continued growth of the region is inevitable. A notable feature of the plan is the conservative capitalization, the only increase being to carry out the necessary extensions or improvements.

Special Franchise Assessments for 1912 in Greater New York.—The New York State Board of Tax Commissioners has fixed the special franchise assessment in Greater New York for 1912 at $454,253,600 as compared with $481,018,100 in 1911. The largest assessment, $95,055,000, is that of the Consolidated Gas system and that of the Metropolitan Railway Company is next largest, amounting to $73,600,000. Among the principal assessments are: Manhattan Railway Company, $73,600,000; Brooklyn Rapid Transit system, $51,091,600; Metropolitan Railway system, $42,538,000; New York Telephone Company, $50,500,000; Brooklyn Union Gas system, $20,415,000; Edison Electric Illuminating Company of Brooklyn, $13,900,000; Empire City Subway Company, Limited, $10,100,000; Hudson & Manhattan Railroad Company, $8,100,000; Pennsylvania Tunnel & Terminal Railroad Company, $16,162,000; trustees of New York & Long Island Railroad Company, $2,900,000; Third Avenue Railroad Company, $7,500,000; Union Railway Company, $4,735,000; Coney Island & Brooklyn Railroad Company, $2,580,000.

Kentucky Central-Station Deal.—Further developments in the negotiations previously noted in these columns toward a transfer of ownership of the electric light, power and water companies of Hopkinsville, Frankfort, Owensboro, Henderson and Bowling Green, Ky., came last week when it was announced that control in the public utility properties of Hopkinsville and Bowling Green had been shifted through Chicago attorneys and financiers to a syndicate of Philadelphia capitalists. Last week it was reported that a deal for the electric and water properties of Frankfort, Ky., is pending and will be consummated in the near future. The progress of the syndicate during the past fortnight in either buying or obtaining option upon the stock of desirable public-service corporations in the Bluegrass State indicates that the Kentucky Utilities Company, a holding company which is in contemplation, will be formed in the very near future. T. Lindsey Fitch, of Louisville, Ky., is handling the transaction from a local end and stated that about $750,000 will be expended in securing the desired Kentucky companies. A meeting of the capitalists interested will be held in Louisville between Jan. 27 and Jan. 30.

Milwaukee Electric Railway & Light Company Bond Issues.—Banking interests are offering $3,000,000 general and refunding 5 per cent gold bonds of the Milwaukee Electric Railway & Light Company, dated Dec. 1, 1911, and due Dec. 1, 1951. The company was organized in January, 1896, and has continuously since that date owned and operated substantially the entire street-railway, electric-light and power business and a steam-heating system in the city of Milwaukee. Its authorized capitalization consists of $20,000,000 common stock, of which $9,000,000 has been issued, and on which a regular dividend of 6 per cent is paid, and $4,500,000 6 per cent non-cumulative preferred stock, all of which has been issued. The total bonds outstanding, including the present issue, aggregate $16,228,000.

Toledo Railway & Light Reorganization.—The United States Mortgage & Trust Company has filed an application in the Federal Court at Toledo, Ohio, for a receiver for the Toledo Railway & Light Company. This application, it is understood, is the first formal step in the reorganization of the company. It was brought about by the bondholders' protective committee, which has permitted the company to default the interest on its 4 per cent bonds for the past three years. A meeting of the bondholders and stockholders' committee will be held about the middle of this month to pass upon terms of a reorganization plan.

Electric-Service Consolidation in Central Illinois.—The Central Illinois Utilities Company, of Gilman, Ill., has been incorporated, with an authorized capital stock of $325,000, to combine the electric-service plants in Watseka, Milford, Gilman, Onarga, Chatsworth, Piper City, Fairbury and Forrest, Ill. It is proposed to enlarge the plant in Watseka and rebuild the plant in Fairbury, transmitting from these stations. The company is authorized to supply electricity and other public utilities. The incorporators are Messrs. Harry J. Frith, H. A. Foster and J. B. Grotevant.

Stock Increases.—The Fitchburg Gas & Electric Company, of Fitchburg, Mass., has applied to the Gas and Electric Light Commission for authority to issue new stock amounting to $32,350, the proceeds of which will be applied toward purchase of the property of the Wanossnac Power Company, of Fitchburg, Mass. The Pennsylvania Light & Power Company has increased its capital stock from $630,000 to $1,000,000. The Dayton & Troy Electric Railway Company, of Dayton, Ohio, has increased its capital by $300,000 to $1,300,000.

Pacific Light & Power Company Files $35,000,000 Mortgage.—In keeping with its plans for the construction of a 150,000-hp generating station in the southern San Joaquin Valley, the Pacific Light & Power Company, of Los Angeles, Cal., has filed a mortgage on its properties for $35,000,000 with the United States Mortgage & Trust Company, of New York City. Energy from the plant will be available in the San Joaquin Valley, in Los Angeles and in other cities in southern California.

Public Service Corporation (N. J.) Certificates Offered.—New York banking interests are offering $500,000 6 per cent perpetual interest-bearing certificates of the Public Service Corporation of New Jersey at 106½ and interest yielding 5.65 per cent. These are secured by the deposit of stocks aggregating a total of $58,286,800 of the Public Service Railway Company, the Orange & Passaic Valley Railway Company and the United Electric Company of New Jersey.

Electric Bond & Share Company Will Increase Capital to $10,000,000.—Stockholders of the Electric Bond & Share Company, New York City, will meet Jan. 22 to authorize an increase in capital stock from $4,000,000 to $10,000,000, of which $5,000,000 will be preferred. It is also planned to make the preferred 6 per cent cumulative instead of 5 per cent.

Chicago & Oak Park Elevated.—The United States Court has granted authority to Samuel Insull, the receiver of the Chicago & Oak Park Elevated Railroad Company, to issue receivers' certificates to the amount of $2,000,000 to pay the company's debts and improve the property.

Nebraska Bell Telephone Properties Sold.—Advices from Lincoln, Neb., state that the Nebraska Bell Telephone Company has sold its properties in twenty-two counties of the South Platte section to the Lincoln Telephone & Telegraph Company for $2,525,750.

MARKET PRICES.

	Jan. 3.	Jan. 10		Jan. 3.	Jan. 10
Allis-Chalmers	1⅜	1	General Electric....	155¼	159
Allis-Chalmers, pf...	8*	8*	Mackay Companies..	78½*	78*
Amalgamated Copper.	66	66	Mackay Cos., pf....	69⅞*	69*
Boston Edison.....	296	297	Philadelphia Elec...	17⅝	17⅛
C'monwealth Edison	135½*	139	Western Union.....	79⅞	81
Elec. Storage Bty...	53	53¼	Westinghouse	68	71¾
Elec. Stor. Bty., pf.	30*	30*	Westinghouse, pf....	117½*	117½

*Last price quoted.

Personal.

Mr. H. E. Morton has succeeded Mr. D. C. Green as manager of the Albany (Ore.) property of the Oregon Power Company.

Mr. R. M. Jennings, formerly manager of the Coos Bay division of the Oregon Power Company, has been transferred to Eugene, Ore.

Mr. Norman B. Hickox, contract agent for the Muskogee (Okla.) Gas & Electric Company, is recovering from a month's illness with typhoid fever.

Mr. J. B. Whittemore, Rochester, N. Y., has been appointed superintendent of the Gardner (Mass.) Electric Light Company to succeed Mr. W. A. Belcher.

Mr. Louis C. Whitney has resigned as general manager of the Middletown (Conn.) Electric Light Company. No announcement has been made as to the selection of his successor.

Mr. H. J. Scheifer, Jr., formerly electrical inspector for the Allis-Chalmers Company at its Milwaukee plant, has accepted a position as sales engineer with the Rumsey Electric Company.

Mr. Austin Burt, formerly superintendent of the Citizens' Gas & Electric Company, Waterloo and Cedar Falls, Ia., has been made general manager of the company to succeed Mr. William B. Addy.

Mr. R. J. Mack, manager of the contract department of the Fort Smith (Ark.) Light & Traction Company, has been appointed secretary of the Oklahoma-Arkansas Fair Association, which will hold its fair at Fort Smith next fall.

Mr. Samuel Insull, of Chicago, accompanied by Mr. Frederick Sargent, of the same city, sailed on the *Lusitania* on Jan. 10 for England. Mr. Insull is making a flying trip abroad and will be back at his desk in about a month, probably.

Mr. L. J. Lewinson has postponed delivering his lecture on "Modern Forms of Incandescent Lamps," scheduled to be presented before the Electrical Engineering Society of Columbia University on Thursday last, to Thursday, Jan. 18, at 8:15 p.m.

Mr. D. C. Green, formerly of the San Diego (Cal.) company, has been appointed manager of the Coos Bay division of the Oregon Power Company, one of the Byllesby corporations. Until recently Mr. Green was manager for the same interests at Albany, Ore.

Mr. Val. Feadrich, formerly engineer-inspector in the office of the chief engineer of the light and power branch of the New York City Department of Water Supply, Gas and Electricity, has been appointed assistant engineer in the New York Fire Department.

Mr. Harry G. Stoddard has joined the Wyman & Gordon Company, Worcester, Mass., in the capacity of vice-president and general sales manager. Mr. Stoddard was formerly manager of the Washburn & Moen branch of the American Steel & Wire Company and for the past seven years has been president of the Trenton Iron Company, Trenton, N. J.

Mr. Eugene L. Brown has been appointed sales engineer for the American Electric Company of Chicago. Mr. Brown is one of the old guard of the Independent telephone business, having been employed for a number of years by the former American Electric Telephone Company, the Stromberg-Carlson Telephone Manufacturing Company and the Vote-Berger Company.

Mr. E. P. Rowell, formerly general manager of the Plymouth (Mass.) Electric Light Company, has been made president of the Foxboro Electric Company and the Union Electric Light Company, Franklin, Mass. Associated with Mr. Rowell will be Mr. H. R. Wilbur as head of the operating departments and Mr. W. K. Bradbury as head of the new-business departments of the two companies.

Mr. C. D. Warner has recently severed his connection with the Moore Light Company, for which he has been acting as assistant chief engineer for the last fifteen years. Mr. Warner graduated in 1896 from the University of Nebraska and is an associate member of the American Institute of Electrical Engineers and a member of the Illuminating Engineering Society. He will take up work along electrical and illuminating engineering lines.

Mr. James A. Scully, works superintendent for the Whiting Foundry & Equipment Company, of Harvey, Ill., and Mr. George E. Jones, who has had charge of inspection, outside erection and complaint adjustments, have resigned from that company and organized the firm of Scully, Jones & Company, of Chicago, which will engage in engineering, manufacturing and in the sale of foundry, machine-shop and railway supplies.

Mr. J. W. Tabb, who has recently returned from South America, where he spent several months investigating the trade opportunities in Brazil and the Argentine Republic, addressed the Nela Engineering Society, Cleveland, on Jan. 4. Mr. Tabb discussed the credit and trade conditions, the shipping facilities, and in general the methods of doing business in South America. The address was illustrated.

Mr. Frank H. Bethell, vice-president of the Bell Telephone Company of Pennsylvania and associated companies, has been elected president of the Bell Telephone Company of Pennsylvania, the Delaware & Atlantic Telegraph & Telephone Company, the Diamond State Telephone Company and the Chesapeake & Potomac Telephone Company, succeeding Mr. Union N. Bethel, who becomes chairman of the boards of directors of these companies.

Mr. Alexander J. Campbell, general manager of the New London (Conn.) Gas & Electric Company and of the Rockville-Willimantic Lighting Company, has been made general manager of the United Electric Light & Water Company, which has taken possession of the electric-lighting properties of the Housatonic Power Company. Mr. Campbell will retain his connection with the New London Gas & Electric Company, with which he has been associated for seven years.

Mr. Joseph J. Rockwell, of Chicago, for two years manager of the special-service department of the McGraw Publishing Company, has resigned to engage in business for himself as advertising counselor. Mr. Rockwell possesses one of the brightest minds in the advertising business, and he takes with him the cordial good wishes of his old associates. On Jan. 6 he was the guest of honor at a luncheon given by his friends in the Chicago office of the McGraw company and was presented with a silver loving-cup.

Mr. Frederick K. Vreeland has opened an office at 31 Nassau Street, New York, in the Bank of Commerce Building, but retains his laboratory as heretofore at Eightieth Street and East End Avenue (Electrical Testing Laboratories building) for the conduct of experimental work. Mr. Vreeland will practise as consultant on special scientific and technical problems, undertake experimental investigations, tests and demonstrations, and give technical advice to counsel and expert testimony in patent causes.

Mr. Ray Flagg has resigned his connection with the Wagner Electric Manufacturing Company, of St. Louis, Mo., to accept a position as electrical engineer with the Hisey-Wolf Machine Company, of Cincinnati, Ohio. Mr. Flagg had been with the Wagner company since June, 1905, in various engineering capacities, and was recently in charge of motor tests. He will have charge of electrical work in connection with the electrical tools built by the Hisey-Wolf Machine Company. His new business address is Colerain and Marshall Avenues, Cincinnati.

Mr. William G. Chace, of the firm of Smith, Kerry & Chace, Toronto, has moved his headquarters from Winnipeg, Manitoba, to Portland, Ore., and the firm has closed its office in the former place after five years' engagement with the city in the construction of its hydroelectric plant. Mr. Chace will now have charge of the completion of the construction of the works of the Mount Hood Railway & Power Company, as representing the firm of Smith, Kerry & Chace and as assistant manager of the company. His address will be 608 Lewis Building, Portland, Ore.

Mr. Austin C. Dunham, it is reported, will resign the presidency of the Hartford Electric Light Company on Feb. 13, after thirty years of service. Mr. Dunham is one of the best-known electric-light men in the United States, and his company has ever been in the forefront among energetic and progressive electric generating concerns. Owing to

Mr. Dunham's implicit faith in the electrical industry, his company has the distinction of being the first to adopt modern methods of energy transmission from water-power, first to use polyphase transmission apparatus, first to introduce extensively alternating-current inclosed arc lamps, 60-cycle rotary converters and the constant-current, alternating arc-light system. Mr. Dunham led the way to the adoption of the steam turbo-generator as a part of regular central-station equipment and launched the Nernst lamp into commercial being. Moreover, the first storage battery used in connection with central-station service was installed at Hartford, as were also the first tungsten street lamps. Owing to Mr. Dunham's acumen, the Hartford Electric Light Company has thus set the central-station pace of the country, and in the whole State of Connecticut there is not another company engaged in the business which approaches it in aggressiveness of management or stability of growth. Mr. Dunham was born in Coventry, June 10, 1833, and graduated from Yale College in 1854. While the development of the electric-light business has been the crowning achievement of Mr. Dunham's life, his history is not confined to this. He has been prominent in and has headed many different enterprises and has been one of the foremost figures in Hartford's social life. He is president of the Dunham Hosiery Company and the Rock Manufacturing Company, and was one of the founders of the Austin Organ Company. He also gave the Automatic Refrigerator Company its start in the business world. Mr. Dunham is a director of the Ætna Insurnace Company, the Travelers' Insurance Company, the National Exchange Bank, and the Cedar Hill Cemetery Association, and is also a trustee of the Watkinson Juvenile Asylum and Farm School and the Watkinson Library. He is also president of the Hartford Hospital Corporation.

Mr. Otto Martin Rau has tendered his resignation as chief electrician and superintendent of electric lighting for the Milwaukee Electric Railway & Light Company, to take effect on Feb. 15. Mr. Rau started his career in the electrical field with the Daft Electric Light Company, which was superseded by the United Electric Light Company of New Jersey. Subsequently he became associated with the engineering department of the Edison General Electric Company of New York, which was then preparing plans for operating the street cars electrically and installing a central lighting station for the city of Milwaukee. Mr. Rau was appointed resident engineer in charge of the construction work, which covered both the railway and the lighting installations. When these systems were in operating condition he accepted the position of chief electrician for the local company. In this position Mr. Rau had charge of the designing and installing of the electrical equipment in the Oneida Street and Commerce Street generating stations, the trolley system and the overhead and underground lighting distributing system, including a very comprehensive underground-conduit system, and the electrical equipment for the single-phase and 1200-volt interurban railway systems, including substations and transmission lines, the most important of which was a 120-mile, 66,000-volt steel-tower transmission line between Kilbourn and Milwaukee. The latest work, which has just been completed, was the installation of a 40,000-kw addition to the Commerce Street station, including a most comprehensive high-tension switching installation. Mr. Rau has acted as engineer for a number of other properties in which the Milwaukee Electric Railway & Light Company is interested, such as those at Appleton, Neenah, Menasha, Watertown, Kenosha, Racine, South Milwaukee and West Allis. Mr. Rau became an associate of the American Institute of Electrical Engineers in 1903 and was transferred to full membership in 1906.

OTTO M. RAU.

Mr. George Eastman Tripp was unanimously elected chairman of the board of directors of the Westinghouse Electric & Manufacturing Company as successor to the late Robert Mather at a meeting of the board on Jan. 10. For the last three years Mr. Tripp has been prominently identified with the reorganization of the Metropolitan Street Railway Company, representing Messrs. Stone & Webster, of Boston, who were retained by the bondholders' committee. He was made chairman of the joint committee on reorganization, and the plan under which the reorganization of the Metropolitan Street Railway Company has been effected was drawn under his supervision. He was responsible for many of the clauses inserted in the plan whereby the bonds of the traction company have been placed on a recognized footing. Mr. Tripp was vice-president of the Stone & Webster Management Association and of the Stone & Webster Engineering Corporation, from both of which he has resigned to devote all of his time to the Westinghouse company. Mr. Tripp was born in Wells, Maine, April 22, 1865. He entered the employ of the Eastern Railroad before its consolidation with the Boston & Maine, and later was employed by the Thomson-Houston Electric Company in the work of electrifying the West End Street Railway of Boston. Upon the completion of that work, and at the time of the consolidation of the Thomson-Houston Electric Company with the Edison company into the General Electric Company, Mr. Tripp became traveling auditor for the latter. He then joined the Industrial Improvement Company, which was controlled by the General Electric Company, where he had charge of the accounting and financial departments of the interests owned by it. In 1897 he became connected with Messrs. Stone & Webster, for whom he managed Western investments, which lay principally in Texas and on the Pacific Coast. Mr. Tripp has advised and directed the financing, organization and reorganization of some of the largest public-utility corporations in the country. His home is in Hingham, Mass., a suburb of Boston. Mr. E. M. Herr, as president of the Westinghouse Electric & Manufacturing Company, will continue in charge of the operating end of the company, while upon Mr. Tripp will devolve all of the duties heretofore borne by Mr. Robert Mather and which have to do chiefly with the financial and foreign interests of the company. Mr. Tripp is president of the Dallas Electric Corporation, Houston & Northern Texas Electric companies, North Texas Traction Company, Pacific Coast Power Company, Whatcom County Railway & Light Company; vice-president of the Paducah Light & Power Company, Paducah Traction Company, Puget Sound Electric Railway, Puget Sound International Railway & Light Company, Seattle Electric Company, Tacoma Railway & Power Company, and director of the Galveston-Houston Electric Company, Houghton County Street Railway Company, Paducah Traction & Light Company, St. Croix Falls (Minn.) Improvement Company, Pacific Coast Power Company and the Electric Light & Power Company of Abington and Rockland. Many of these will be recognized as Stone & Webster properties. Mr. Tripp is married and has three daughters. He is a member of the Exchange Club of Boston and of the Wompatuck Club of Hingham.

GEORGE E. TRIPP.

Obituary.

Mr. Eugene A. Allen, for about twenty-five years in the employ of the government at the Federal Building, Boston, died suddenly of apoplexy while at his work on Jan. 5. He was fifty-eight years of age, and at the time of his death was electrician of the building, which houses the Post Office, the federal courts and other governmental offices.

Construction.

MORENCI, ARIZ.—Among the improvements contemplated by the Arizona Copper Co. is the installation of a new power plant.

CLARKSVILLE, ARK.—Bids will be received by D. Ward, secretary of Board of Improvement, Clarksville, Ark., until Jan. 19 for installation of an electric-light system. W. N. Cladson, of Fayetteville, Ark., is engineer.

CHICO, CAL.—The Board of City Trustees has awarded the contract for street lighting to the Sacramento Valley Pwr. Co., Redding, Cal., for a period of three years. The Sacramento company is extending its system in the residence district of the city. F. T. Bergin is superintendent.

CRESCENT MILLS, CAL.—The McDonald estate, which owns the Crescent Mine, has decided to reopen and operate the property. An electric plant will be installed in the vicinity of Indian Falls.

LIVE OAK, CAL.—The plant and holdings of the Live Oak & Encinal Lt. & Pwr. Co. have been purchased by the Pacific Gas & El. Co.

LODI, CAL.—The Pacific States Gas & El. Co. is planning to erect an electric transmission line from Stockton to Thornton to supply electricity for pumping purposes. Several substations will be erected.

LOS ANGELES, CAL.—The Board of Public Works has awarded the contract for street lighting to the Los Angeles Gas & El. Co., at $6.30 per lamp per month. The contract calls for the installation of 500 additional lamps.

MARTINEZ, CAL.—The Western Pwr. & El. Lt. Co. is preparing to erect an electric transmission line between Martinez and Oakland. The company also contemplates the construction of substations along the line, which later will be extended between Martinez and Sacramento.

MODESTO, CAL.—Local interests are financing a project to build an electric railway from Modesto to Newman, 22 miles long. T. K. Beard, president of the Modesto & Empire Trac. Co., has offered to build the railway after $150,000 has been subscribed.

OXNARD, CAL.—Plans are being prepared for the installation of an electric-lighting system. The cost of placing the wires underground is estimated at about $25,000.

PLACERVILLE, CAL.—The contract for electric-light fixtures, etc., for the court house has been awarded to Fowler & Mallett, of San Francisco, for $2,500.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Lt. & Pwr. Co. has applied to the Board of Public Works for a permit to erect poles and wires and construct underground conduits throughout the city for the distribution of electricity, beginning at Alameda and Bryant Streets as a center.

SAN JOSE, CAL.—The San Jose Rys. Co. contemplates building an extension between San Jose and Hollister.

SANTA MONICA, CAL.—The electric plant of the Southern California Edison Co., located at Eighth Street and Colorado Avenue, was destroyed by fire recently, causing a loss of about $35,000.

DENVER, COL.—The Denver City Tramway Co. is planning to extend its West Alamedes line through Valverde to Fort Logan.

LONGMONT, COL.—The city of Longmont has purchased the electric plant and the distributing system of the Public Service Co. for $41,500.

BRIDGEPORT, CONN.—Alderman Paul L. Miller, chairman of the lamps committee, has filed his requisition with the city auditor for the coming year, in which he asks for the old appropriation of $66,234 and also for $3,273 additional to be used for the installation of forty-six new arc lamps in various parts of the city.

DANBURY, CONN.—A petition has been presented to the Council asking for an inquiry as to the advisability of establishing a municipal electric-light plant.

LONG HILL, CONN.—Arrangements are being made to install electric lamps on the Sawmill Hill Road, a distance of about 1 mile. Harry A. House has offered to supply electricity for the lamps provided the residents will pay for the installation of the system.

WASHINGTON, D. C.—Proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 23 for furnishing at the navy yard, Brooklyn, N. Y., supplies as follows: Schedule 4230—lead-covered wire, incandescent-lamp cord, fans; schedule 4238—conduit and fittings and electrical supplies. Applications for proposals should designate the schedule desired by number. Blank proposals will be furnished on application to the navy pay office, New York, N. Y., or to the bureau. T. J. Cowie is paymaster-general, U. S. N.

ALBANY, GA.—The installation of an ornamental street-lighting system in the business district is under consideration by the City Council and the Chamber of Commerce.

AMERICUS, GA.—The City Council has passed a resolution calling an election to issue bonds to the amount of $60,000 for the construction of a municipal electric-light plant in connection with the water-works system.

ATLANTA, GA.—At a rehearing the Georgia Railroad Commission has approved the issue of the $27,000,000 in stock of the Georgia Ry. & Pwr. Co., in accordance with the original application.

ATLANTA, GA.—In the annual report submitted by City Electrician R. C. Turner to the Mayor and City Council the erection of a 5000-hp electric power plant at the Hemphill water-works pumping station is recommended.

ATLANTA, GA.—Among the improvements contemplated by the Georgia Ry. & El. Co. during 1912 are the installation of additional boilers and a new turbine at the Davis Street station and possibly an additional rotary converter at the Walton Street substation.

MACON, GA.—The Central Georgia Transm. Co. has filed an application with the State Railroad Commission for permission to issue $2,000,000 in capital stock and $2,500,000 in bonds. The company is a subsidiary of the Central Georgia Pwr. Co. and proposes to erect transmission lines from Griffin northward to Atlanta and to erect substations at various points along these lines and in and around the city of Atlanta. The transmission company will secure energy from the power plant of the Central Georgia Pwr. Co, on the Ocmulgee River, near Jackson. W. J. Massee, of Macon, is president of both companies.

WASHINGTON, GA.—Bids for the construction of power plant and improvements and extension of electric-light and power transmission system have been rejected by the city of Washington, and new bids will be received until Jan. 20. Plans were prepared by Westinghouse, Church, Kerr & Co., engineers, of New York, N. Y. Boyce Ficklen, Jr., is city clerk.

WAYCROSS, GA.—W. M. Toomer, of Jacksonville, Fla., contemplates building an electric railway several miles long in the suburbs of Waycross, which will be operated by the Waycross El. Ry. Co.

LAPWAI, IDAHO.—The Tom Beall Tel. Co. is planning to erect a telephone line from Lapwai to Tom Beal Creek. W. W. Olds and Daniel Moore are interested.

CANTON, ILL.—Extensive improvements and extensions are contemplated by the Canton Gas & El. Co. during 1912, which include the erection of an addition to its boiler house to provide space for two 300-hp boilers, with coal bunkers, ash conveyors, etc., which will be provided with automatic stokers. It is also proposed to install another 750-kw generating unit. Plans are also being considered by the company to extend its transmission lines to St. David. Negotiations are under way with the village of Cuba, which already has a municipal electric-light plant. It is understood that many of the residents are dissatisfied with the service and would prefer to obtain the service from a private corporation. It is understood that the street lamps would cost the village of Cuba about $1,800 per year, which is much less than the cost of operating the municipal plant. E. H. Negly is secretary and manager.

EAST ALTON, ILL.—The Village Board has awarded the contract for street lighting to the Illinois Trac. System. A minimum of twenty-two 250-watt lamps will be supplied at $45 each per year.

KEITHSBURG, ILL.—The Ridgway El. Lt. & Pwr. Co. is erecting a transmission line to Orangeville.

MOLINE, ILL.—The installation of from twenty-five to fifty additional arc lamps is under consideration. The electric-lighting service is supplied by the People's Pwr. Co.

ORENZVILLE, ILL.—The Village Council is considering the question of establishing a lighting plant. Orenzville has not a post office.

SPRINGFIELD, ILL.—Surveys are being made by the Springfield & Central Illinois Trac. Co. for its proposed railway from East St. Louis to Oscaloosa, a distance of 80 miles. The East St. Louis Engineering Co. has charge of the work.

WOODLAND, ILL.—The International Harvester Co. has secured the contract for equipment for the municipal electric-light plant.

COLUMBIA, IND.—Steps have been taken by Samuel Harshberger, owner of the Tri-Lakes resorts, for the construction of an electric railway from Columbia City to these resorts.

ELWOOD, IND.—The property of the Elwood El. Lt. Co. has been purchased by the American Gas & El. Co. The Elwood plant will supply electricity in Alexandria and work will begin immediately on the erection of a transmission line between the two cities. Later, it is stated, a line will be built from Alexandria to Muncie and a line will eventually be erected between Alexandria and Marion.

EVANSVILLE, IND.—Work will soon begin by the Evansville Rys. Co. on the construction of an electric railway from Evansville to Henderson.

EVANSVILLE, IND.—The capital stock of the Evansville, Henderson & Owensboro Ry. Co., has been increased from $10,000 to $50,000.

FORT WAYNE, IND.—A petition has been presented to the Board of Public Works by the business men of Columbia Street asking that ornamental street lamps be installed on Columbia Street. The business men agree to pay the cost of installation provided the city will supply the current.

INDIANAPOLIS, IND.—The Indianapolis & Cincinnati Trac. Co. has decided to extend its railway from Greensburg, Ind. to Harrison, Ohio.

LAUREL, IND.—Plans are being prepared for the installation of an electric-light plant in Laurel. Harry Jones, of Laurel, is interested.

MARION, IND.—Plans are being considered by the business men for the installation of a cluster street-lighting system in the business section. H. S. Smith is chairman of lighting committee.

BOONE, IA.—The Boone El. Co. has filed a trust deed which provides for a bond issue of $1,000,000.

DUBUQUE, IA.—The City Council has adopted an ordinance providing for a boulevard system of street lighting.

MENLO, IA.—An electric-light franchise has been granted to George C. Buckley & Co.

OTTUMWA, IA.—Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 24 for installation of electric passenger elevator in the United States building at Ottumwa, Ia., according to plans and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

PERRY, IA.—C. R. Lyon has purchased an interest in the Perry El. Lt., Pwr. & Htg. Co. Improvements to the system are contemplated.

INDEPENDENCE, KAN.—The Kansas Gas & El. Co., which recently took over the property of the Independence El. Co., has purchased a site on which it proposes to erect a large power house.

MACKSVILLE, KAN.—The installation of a municipal electric-light plant is reported to be under consideration, for which a special election will soon be called to submit the proposition to a vote.

BOWLING GREEN, KY.—A consolidation of several electric railways and gas and electric plants in small cities in Kentucky has been consummated. The new company, it is said, will be known as the Kentucky Utility Co., and will include the Bowling Green St. Ry. Co., the Gas Lt. Co. and the companies operating public utilities in Frankfort, Hopkinsville, Henderson, Paducah and Owensboro. The headquarters of the new company will be located in Louisville. All the systems in the different cities will be reconstructed and many improvements made. T. Lindsay Fitch, of Louisville, is interested.

BALTIMORE, MD.—Specifications for constructing underground conduits to connect the city hall, court house and city hall annex with the new high-service pumping station have been approved and bids authorized for the work, which will be received until Jan. 17.

BARNSTABLE, MASS.—The Buzzard's Bay El. Co. has applied to the Gas and Electric Light Commissioners for permission to supply gas in Barnstable.

CLINTON, MASS.—The Selectmen contemplate replacing the arc lamps with incandescent lamps in the Duck Harbor district.

FITCHBURG, MASS.—The Board of Trade and Merchants' Association presented a petition to the City Council asking that ornamental lamps similar to those installed on Main Street between Oliver and Fox Streets be extended the entire length of Main Street.

FITCHBURG, MASS.—The Fitchburg Gas & El. Co. has applied to the Board of Gas and Electric Light Commissioners for permission to issue 647 shares of capital stock at $85 (par value $50), the proceeds to be used to purchase the property of the Wanoosnoc Pwr. Co., of Fitchburg.

GEORGETOWN, MASS.—The installation of an electric street-lighting system is under consideration.

HOLBROOK, MASS.—The Selectmen have granted the Weymouth Lt. & Pwr. Co. permission to erect transmission lines on Weymouth Street.

HOLYOKE, MASS.—Preparations are being made to equip the Holyoke mills of the American Thread Co., with the exception of the Hadley division, with electrically driven machinery.

PITTSFIELD, MASS.—The Railroad Commission has given its approval of the proposed extension of the electric-railway system in Pittsfield, which is to be built by the New York, New Haven & Hartford R. R. Co. under the provisions of the Legislature authorizing the company to take over the system of the Berkshire Street Ry. Co.

PROVINCETOWN, MASS.—The Cape Cape Lt., Ht. & Pwr. Co. is planning to install additional street lamps at its own expense.

REVERE, MASS.—At a town meeting held Jan. 8 it was voted to enter into a ten-year contract with the Suburban Gas & El. Co. for street lighting. The company is to supply 146 6.6-amp arc lamps at $73.36 each per year and about 250 incandescent lamps at $16.55 each per year. The maximum price for electricity for lamps is to be reduced from 13 cents to 12 cents per kw-hour, beginning with Feb. 1, and on July 1, 1912, will probably be reduced to 11 cents per kw-hour.

SPRINGFIELD, MASS.—Plans have been approved by the Selectmen for additional street lamps, including both arc and incandescent lamps.

CORUNNA, MICH.—The city of Corunna has decided to erect a municipal electric-light plant in connection with the water-works system. Work will begin on construction of plant as soon as plans and estimates have been prepared.

ISHPEMING, MICH.—The property of the Marquette County Gas & El. Co., including the local electric and gas plants and street railway connecting Ishpeming and Negaunee, has been purchased by L. E. Myers Co., of Chicago, Ill., for $400,000.

LANSING, MICH.—The Michigan-Indiana Trac. Co. is preparing to begin work on construction of its electric railway between Columbia and Coldwater. Walter Power, of Battle Creek, is interested.

ROMEO, MICH.—At a special election held Dec. 27 the proposition to sell the municipal electric-light plant to the Eastern Michigan Edison Co. was carried. The company offered to pay $18,000 for the plant.

CHISHOLM, MINN.—The Mesaba Range Pwr. Co. has submitted a proposition to the Village Council offering to sell the plant to the village. The company is in the hands of a receiver.

FERGUS FALLS, MINN.—A franchise has been granted to S. O. Bridson and associates for a street-railway system.

GILBERT, MINN.—The village officials are negotiating with D. A. Reed, engineer, of Duluth, in charge of the St. Louis River project, to secure electricity for lamps and motors. The proposed plan will include the erection of a 17-mile transmission line.

HANCOCK, MINN.—The installation of an electric-light plant is being considered by Fred Jensen.

LAKE PARK, MINN.—H. W. Hicks, of Verndale, Minn., is considering the installation of an electric-light plant here. The equipment of his plant in Verndale may be used.

MANKATO, MINN.—The Mankato Elec. Trac. Co. is contemplating extending its system to North Mankato.

MANKATO, MINN.—Negotiations are under way by the village of North Mankato for the installation of a fire-alarm system.

RED LAKE FALLS, MINN.—The Red River Pwr. Co. has been granted a franchise to install an electric-light and power plant. A contract for street lighting was awarded the company.

WILLMAR, MINN.—Improvements are contemplated to the municipal electric-light plant which will involve an expenditure of about $15,000.

NATCHEZ, MISS.—The Southern Ry. & Lt. Co. is planning to extend its railway system to Auburn Park.

ST. LOUIS, MO.—The Suburban El. Lt. & Pwr. Co. is planning to build an electric transmission line into Jennings.

ROUNDUP, MONT.—Plans are being considered for the construction of an electric railway to connect this city with adjoining coal camps, for which $11,000 has been subscribed. It is proposed to form a company to be known as the Roundup Ry., Lt. & Pwr. Co., to be capitalized at $50,000.

DE WITT, NEB.—Local engineers have been making investigations with a view of securing a suitable location on the Blue River for the erection of a dam to secure water-power to operate an electric-light plant.

OMAHA, NEB.—The Omaha Elec. Lt. & Pwr. Co. has asked for an extension of its franchise and for permission to install flaming-arc lamps.

STOCKVILLE, NEB.—The Commercial Club is reported to be interested in the project to establish an electric-light plant in Stockville.

YORK, NEB.—A petition is being circulated to call an election to vote on the proposition to issue $125,000 in bonds for the installation of an electric-light plant and water-works system.

RENO, NEV.—Application has been made to the City Council for a franchise to operate an electric plant and lay water mains by H. G. Comstock, who, it is understood, represents the new company which is to construct a power plant near the Logmasino ranch, near Reno.

CAMDEN, N. J.—The City Council has appointed a committee to make investigations in connection with the establishment of a municipal electric-light plant.

ELIZABETH, N. J.—The Central R. R. of New Jersey has been granted a permit for the erection of a power house, adjoining its Elizabethport shops, to cost about $30,000.

ALBUQUERQUE, N. M.—The Albuquerque Gas. El. Lt. & Pwr. Co. is contemplating the installation of an ornamental five-lamp-cluster street-lighting system in the business district. The company also contemplates extending its transmission lines down the valley 15 or 20 miles to supply electricity for irrigation purposes.

NEW YORK, N. Y.—The Brooklyn & North River R. R. Co. has applied to the Public Service Commission for permission to build and operate a street railway from the intersection of the Flatbush Avenue extension and Fulton Street, borough of Brooklyn, across the Manhattan Bridge and through Canal and other streets to West Street, near Desbrosses Ferry.

NEW YORK, N. Y.—Bids will be received by Cyrus C. Miller, president of the borough of the Bronx, Municipal Building, Crotona Park, 177th Street and Third Avenue, until Jan. 18, for installing a complete lighting system where not heretofore installed and for fixtures, together with all work incidental thereto, in the Municipal Building, located at Third and Tremont Avenues.

PATCHOGUE, N. Y.—The Patchogue El. Lt. Co. has applied to the Public Service Commission, Second District, for permission to exercise a franchise for furnishing electrical service in Southampton.

SCHENECTADY, N. Y.—The Schenectady Ill'g Co. is contemplating replacing the present electric pumps at the Rotterdam wells with two pumps of 12,000,000 gal. capacity per day.

WATERFORD, N. Y.—The Board of Village Trustees has awarded the contract for lighting the streets of the village to the Troy Gas Co. The company is to furnish forty-five lamps at the rate of 24 cents each per night.

CHARLOTTE, N. C.—Several contracts have been awarded for the construction of local stations at Charlotte, Greenville, Anderson and Gastonia, along the line of the Interurban Traction route in North and South Carolina. These stations will cost from $8,000 to $20,000 each and will be ready for use by April 1.

WINSTON-SALEM, N. C.—The Blue Pearl Granite Co. is planning to remove its plant to a site on Liberty Street and install additional machinery, including an 8-ton electric traveling crane with two motors, polishing machines driven by 20-hp motors, surfacing machines, compressor operated by 75-hp motor, and one 100-hp motor to operate remaining machinery.

AGRICULTURAL COLLEGE, N. D.—Sealed bids will be received by the board of trustees of the North Dakota College until Jan. 16, 1912, for installing complete a generating unit consisting of a 116-hp engine and a three-phase, 60-cycle alternating-current generator with accessories, in accordance with plans and specifications prepared by John Anderson, which may be seen at the office of W. A. Yoder, secretary, or at the Builders & Traders' Exchange, Fargo and Grand Forks, N. D.

FARGO, N. D.—Surveys have been completed by the Fargo & Moorehead Street Ry. Co., between Moorehead and Fargo, a distance of 3 miles. It is expected that a loop will be built in Dilworth.

COLUMBUS, OHIO.—The contract for furnishing 320 4-amp magnetite-arc lamps and four seventy-five-lamp rectifier equipments for magnetite lamps has been awarded to the General El. Co., of Schenectady, N. Y., for $11,190. The Burke El. Co., of Erie, Pa., was awarded the contract for two 400-kw synchronous condensers, at $5,200. Wirt S. Scott is superintendent of the department of lighting.

ROCKFORD, OHIO.—The Rockford Tel. Co. has increased its capital stock from $5,000 to $10,000.

SALEM, OHIO.—The Salem El. Lt. & Pwr. Co. has taken over the franchise and distributing system of the Columbiana County Lt. & Pwr. Co. in Salem.

TOLEDO, OHIO.—The City Council is considering improvements to the lighting system on several streets.

TOLEDO, OHIO.—The Toledo Rys. & Lt. Co. contemplates the construction of a new power plant, which may be located outside of the city limits. The Water Street plant will supply electricity for commercial and street lamps.

YOUNGSTOWN, OHIO.—The Youngstown Southern Ry. Co. contemplates the construction of an electric railway from Columbiana to East Palestine, a distance of 10 miles.

LAKEVIEW, ORE.—The Warner Lake Irrig. Co., of Portland, Ore., has filed application for additional sites and water supply in Lake County. The company proposes to utilize the waters of Honey and Deep Creeks to irrigate about 150,000 acres of land in Warner Valley and to generate electricity. The present plans include the erection of three reservoirs and the construction of a hydroelectric plant and the installation of pumping plants on Flagstaff Lake. The cost of the project is estimated at $3,000,000.

PANAMA.—Sealed proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Jan. 22 for steel reinforced bars and centrifugal pump direct-connected to induction motor and mounted on truck together with necessary fittings. Blanks and general information may be obtained at the above office. Major F. C. Boggs is general purchasing agent.

BLAIRSVILLE, PA.—The property of the Citizens' Lt., Ht. & Pwr. Co. has been purchased by H. J. Walbridge & Co., of New York, N. Y. Work will begin on the construction of a street railway from Blairsville to Blairsville Intersection, a distance of 3 miles, as soon as the weather will permit.

DOYLESTOWN, PA.—The Bucks County El. Ry. Co. has purchased the railway of the Pennsylvania & New Jersey Trac. Co., which extends from Newtown to Trenton, 10 miles long. The railway will be rebuilt and equipped with new cars.

HARRISBURG, PA.—The City Council has voted to erect additional electric street lamps in various parts of the city.

OIL CITY, PA.—Application has been made to the City Council for a twenty-one-year extension for the franchise of the Citizens' Lt. & Pwr. Co. It is proposed to reorganize the traction and light companies and make improvements to the railway and power plant, which will involve an expenditure of about $200,000. The railway, which now covers Oil City and Franklin, will be extended to Butler.

PITTSBURGH, PA.—Bids will be received at the office of the city controller until Jan. 18 for lighting the streets of the city with arc and incandescent electric lamps and also for furnishing incandescent mantle lamps for a term of one year.

PITTSBURGH, PA.—The Carnegie Steel Co. has entered into a contract with the Allegheny County Lt. & Pwr. Co. for electrical energy to the amount of 1000 hp to experiment with as motive power for its Painter Mill on the South Side. The power contracted for will enable about one-eighth of the equipment in the mill to be operated by electricity, and, if satisfactory, this will be extended.

ST. PETER'S, PA.—Plans are being prepared by the William Russell Smith Co. for the development of water-power in French Creek Rapids at St. Peter's for the French Creek Granite Co., which will consist of dam, flume, penstock and power plant.

WYOMISSING, PA.—The Sinking Spring Lt., Ht. & Pwr. Co. has submitted a proposition to the Town Council relative to the installation of new incandescent lamps in the borough.

COLUMBIA, S. C.—The Columbia Ry., Gas & El. Co. contemplates the construction of a dam to develop 30,000 hp for transmission by electricity.

ABERDEEN, S. D.—The Aberdeen Lt. & Pwr. Co. is contemplating the construction of a complete new power plant, to cost approximately $200,000. The installation of a heating plant is said to be under consideration.

OLIVET, S. D.—A company is being formed under the name of the Olivet Interurban Ry. Co. for the purpose of constructing an electric railway from Olivet to Tuscan, which will eventually be extended to Mitchell.

WAKONDA, S. D.—The Wakonda Lt., Pwr. & Htg. Co. has commenced work on the construction of an electric-power plant. F. A. Swezey is president and Sampel Jacobson secretary.

COLUMBIA, TENN.—A company will be organized for the purpose of supplying electricity and water in Granbery, Jackson and Nashville, Tenn. It is said that the company will make investigations and report on the condition of the electric-light plant and water-works system of the Columbia Water & Lt. Co.

KNOXVILLE, TENN.—Extensive improvements are contemplated by the People's Tel. & Teleg. Co., including the installation of a common-battery system and automatic-call distributing system.

NASHVILLE, TENN.—The Nashville Ry. & Lt. Co. is planning to build an auxiliary power plant, work on which will begin in the near future. It is understood that equipment is being purchased. Percy Warner is president.

WOODBURY, TENN.—The installation of an electric-light plant is under consideration by the City Council, for which estimates of cost and maintenance have already been prepared.

AUSTIN, TEX.—The Del Valle Irrigation Co., Littlefield Building, Austin, Tex., is planning to build a reinforced-concrete dam 9 ft. high, 324 ft. long, about 9 miles from Austin. The water will be used to irrigate 10,000 acres of land and also to generate electricity to operate six large gins. T. U. Taylor, dean of the engineering faculty of the University of Texas, is engineer in charge. D. B. Matthews is president.

DALLAS, TEX.—The Board of Municipal Commissioners has instructed the secretary to call for bids for lighting the streets of the city.

JARRELL, TEX.—Plans are being prepared for the installation of a new electric-light plant in Jarrell. Material for the proposed plant, it is understood, has been purchased. Jarrell has not a post office.

PLAINVIEW, TEX.—F. N. Simmons, R. R. McCutchen, W. J. Riddell and B. F. Kaufman, of Des Moines, Ia., are interested in a project to develop 18,000 acres of land near Plainview. The installation of an electric-power plant is contemplated. For further information address R. R. McCutchen, 210 Fifth Street, Des Moines, Ia.

SINTON, TEX.—The Sinton Ice & Lt. Co. has awarded contracts for construction of power house to Martin Wright, of San Antonio, Tex. It is understood that contracts for machinery have been placed. The company will operate an ice plant in connection with the electric plant. L. Fouts is president and G. H. Ferguson vice-president and manager.

TAYLOR, TEX.—The Taylor Ht. & Lt. Co., of North Lima, Ohio, has been granted a permit to do business in Taylor. The company is capitalized at $30,000.

PROVO, UTAH.—The merger of the Knight Pwr. Co., of Provo, and the Utah County Lt. & Pwr. Co., of American Fork, will mean the construction of several additional power plants, some in Utah and others in southern Idaho. A plant is to be erected on Weber River next spring, for which machinery has already been purchased. A transmission line will be erected from the Snake Creek plant to the Weber plant and from there down Parley's Canyon to connect with the line at Midvale. Jesse Knight, of Provo, is president of the Knight Pwr. Co.

SALT LAKE CITY, UTAH.—The City Council has entered into a contract with the Utah Lt. & Ry. Co. for lighting the streets of the city for a period of two years, under the terms of which the company is to furnish 845 arc lamps at $60 each per year.

SPANISH FORK, UTAH.—The Palmyra Tel. & El. Lt. Co., recently incorporated, proposes to secure electricity from the government plant at the mouth of Spanish Fork Canyon and distribute it to various small towns in the southern portion of the county.

DILWYN, VA.—The Dilwyn Ice, Lt. & Preserving Co. is planning to install an electric-light plant and a 5-ton ice plant. James S. Steele is interested.

CATHLAMET, WASH.—Application has been made to the Town Council by M. Hayward, of Portland, Ore., for a franchise. The project includes the construction of a dam on Elocoman River and the erection of a power plant, to cost approximately $15,000.

ELLENSBURG, WASH.—The City Council has voted to erect cluster lamps in the business section of the city.

HUSUM, WASH.—The Husum Tel. Co. contemplates the construction of the erection of a telephone line from Trout Lake to Underwood, a distance of 30 miles.

KIRKLAND, WASH.—The Kirkland-Redmond Ry., Lt. & Pwr. Co., recently incorporated with a capital stock of $200,000, contemplates the construction of an electric railway between Kirkland and Redmond and other points in King County. The incorporators are: C. A. Eaton, B. F. Gordon, William Perigo, Samuel G. Hepler and W. D. Gillis. The main office of the company is located in Seattle, Wash.

SEATTLE, WASH.—The Seattle, Renton & Southern Ry. Co. has been authorized to build a double track on Washington Street and make other improvements to its local system.

SEATTLE, WASH.—The Puget Sound El. Co. has applied to the Board of County Commissioners for a franchise to erect transmission lines on the county roads to supply electricity for lamps and motors in Kent and Auburn and surrounding territory.

SPOKANE, WASH.—Extensive improvements and extensions are contemplated by the Home Tel. Co. to its system in Spokane, which will involve an expenditure of about $500,000. An exchange will be erected in Hillyard, to cost approximately $128,200. Thaddeus S. Lane is president.

TROUT LAKE, WASH.—The Northwestern El. Co. has purchased the property and holdings of the Wind River Lumber Co. in this district, consisting of lands along the White Salmon River. The company proposes to erect dams on the Lewis River and near the narrows of the White Salmon River for the purpose of generating electricity for railroad interests.

CLAYSVILLE, W. VA.—The Wheeling & Elm Grove Ry. Co. is planning to extend its railway from West Alexander to Claysville.

KAUKAUNA, WIS.—The State Railroad Commission has fixed the price to be paid by the city of Kaukauna for the property of the Kaukauna Gas. El. Lt. & Pwr. Co. at $50,000.

MADISON, WIS.—The Chicago & Wisconsin Valley El. R. R. Co. has petitioned the Wisconsin Railway Commission for permission to construct an electric interurban railway between Madison and Portage, Wis., a distance of about 36 miles. The railway will ultimately be extended to Merrill and Janesville. The company will construct a hydroelectric power plant on the Wisconsin River to generate energy to operate the system.

NEENAH, WIS.—The Wisconsin Trac., Lt., Ht. & Pwr. Co. contemplates extending its electric-light and gas service to Little Chute and Kimberly and probably to Kaukauna.

SUPERIOR, WIS.—Plans are being considered to substitute electricity for steam power to operate the coal-handling machinery on the Lehigh Valley Coal Co.'s dock on Tower Bay.

WAUWATOSA, WIS.—Sealed proposals will be received at the office of Martin Plehn, county clerk, Milwaukee, Wis., for furnishing material and installing ornamental lamps, standards and lamps for lighting the Grand Avenue viaduct in the town of Wauwatosa, according to plans and specifications on file in the office of the county clerk.

VANCOUVER, B. C., CAN.—The Canadian North-Eastern Pwr. Co., Ltd., of Vancouver, B. C., has filed application for a license to appropriate 300 cu. ft. per second of water from a stream flowing from Meziadin Lake to Naas River, the water to be used to generate electricity. The work will include construction of power house, flume, tunnel, etc. For further information address the Canadian North-Eastern Pwr. Co., Ltd., care of Mackenzie, Mann & Co., Vancouver, B. C., Can.

BRAMPTON, ONT., CAN.—The ratepayers on Jan. 1 voted in favor of the by-law to purchase the franchise of the Brampton El. Lt. Co.

ESSEX, ONT., CAN.—Announcement has been made that the Essex Light & Power Company has filed an application for amendments to its charter with the Department of Public Works, together with a plan of six proposed cables to be laid on the bed of the Detroit River from a point in the town of Sandwich to the Fort Wayne distributing station of the Edison Illuminating Company in Detroit, for the purpose of supplying electricity in towns and villages in Essex County. Stewart Stuart, of Detroit, Mich., is said to be at the head of a project to secure electrical energy from Detroit to supply a number of towns and villages throughout Essex County, including Essex, Kingsville, Leamington and Amherstburg, which now operate small plants of their own.

GUELPH, ONT., CAN.—At an election held Jan. 1 the ratepayers voted in favor of the by-law to appropriate $13,500 to extend the street-railway system.

LUCAN, ONT., CAN.—At the election held Jan. 1 the ratepayers voted in favor of the by-law giving a bonus to the North Midland El. Ry.

PORT CREDIT, ONT., CAN.—The by-law calling for an expenditure of $7,500 for the installation of a transformer and distributing system for the hydroelectric system was carried at the election held recently.

RENFREW, ONT., CAN.—At an election held Jan. 1 the by-law to appropriate $60,000 for extensions to the municipal electric-light plant was carried.

TORONTO, ONT.—At the municipal election held Jan. 1 by-laws calling for appropriations of $4,122,000 for public improvements were carried, of which $2,200,000 will be required for extensions to the hydroelectric power system. Construction of a civic railway will involve an expenditure of $138,000 and the viaduct project will cost about $1,783,333.

TORONTO, ONT., CAN.—The following is a list of the cities and villages which voted on Jan. 1 in favor of entering into a contract with the Hydroelectric Commission to furnish electricity: Ailsa Craig, Blyth, Cayuga, Clinton, Exeter, Goderich, Hagersville, Hastings, Hensall, Kincardine, Kingston, Lakefield, Listowel, Lucan, Owen Sound, Paisley, Paris, Peterboro, Prescott, Richmond Hill, Thornbury, Welland, Wingham and Wroxeter. The Hydroelectric Commission, it is said, will expend more than $4,000,000 in extensions during the next two or three years. Adam Beck is chairman of the commission.

WIARTON, ONT., CAN.—At an election held Jan. 1 the ratepayers voted in favor of the by-law to enter into a contract with the Hydroelectric Power Commission for electrical power.

WOODSTOCK, ONT., CAN.—At an election held Jan. 1 the ratepayers voted in favor of the by-law to appropriate $10,000 for extensions to the street-lighting system.

New Incorporations.

LA SALLE, ILL.—The Cedar Point Light & Water Company has filed articles of incorporation with a capital stock of $10,000 to supply electricity for lamps, heat and motors. The incorporators are: James Stillwell, Robert W. Richardson and Thomas H. Stevenson.

NOBLESVILLE, IND.—The Deming Telephone Company has been incorporated with a capital stock of $10,000 for the purpose of constructing and operating a telephone system throughout Hamilton County. The directors are: James B. Studdert, M. Jessup and B. Jessup.

OLDENBURG, IND.—The Oldenburg Electric Light, Power & Water Company has been incorporated with a capital stock of $15,000 by George Holtel, Sr., Joseph Schmidt, N. G. Gloshen and B. J. Kessing. The company proposes to build and operate an electric-light plant to supply electricity for lamps, heat and motors in Oldenburg and vicinity.

Trade Publications.

OUTLET BOXES.—A condensed catalog, "H," issued by the Steel City Electric Company, Pittsburgh, Pa., describes the National Code standard stamped steel outlet boxes. These possess knock-out plugs, cover ears and arrangements for cover adjustment. A complete price list takes up the greater part of the bulletin.

VACUUM AND STUFF PUMPS.—The Goulds Manufacturing Company, Seneca Falls, N. Y., has issued Bulletin No. 106, describing single-acting triplex plunger stuff pumps, double-acting piston and single-acting triplex piston vacuum pumps. Specifications, general dimensions and illustrations of the various units are included.

Business Notes.

MR. ALBERT SCHEIBLE of Chicago, research engineer and solicitor of patents, has removed his office to 1519 Marquette Building.

W. N. MATTHEWS & BROTHER have removed from 227 North Second Street to 3727 Forest Park Boulevard, St. Louis, Mo.

MR. E. F. SNELL, who has been a traveling salesman in the East for the H. T. Paiste Company of Philadelphia, is now located at the Chicago office of that company.

BRONZE AND BRASS ALLOY CASTINGS.—The National Conduit & Cable Company, New York, has added to its various departments a large brass foundry under special laboratory supervision for making high-class castings of all descriptions.

CHARLES H. THRALL & COMPANY, electrical contractors, Havana, Cuba, with New York offices at 73 Warren Street, dissolved the firm partnership agreement on Dec. 21, 1911. All communications for the present should be addressed to Havana, Cuba, in the name of the firm.

MR. FRANK MACGOVERN, of the late firm of MacGovern, Archer & Company, which has been dissolved by mutual consent, has organized the firm of MacGovern & Company, Inc., which will carry on a business in new and second-hand electrical and steam machinery. Commodious offices have been secured at 114 Liberty Street, and a large line of various kinds of equipment will be carried in stock. Mr. MacGovern's experience of fifteen years in this line of business has brought him a large acquaintance in the electrical field, which, coupled with a wide knowledge of the lines of business which he will conduct, augurs well for the success of the new company which he has formed.

THE BALTIMORE ELECTRICAL SUPPLY COMPANY, Inc. (of Atlanta), has leased space in the buildings at 83, 85, 87 and 89 Marietta Street, Atlanta, Ga., and will carry a sufficiently large and assorted stock of electrical supplies and construction material to cater for the jobbing, isolated-plant and mill business through South Carolina, Georgia, Florida, Alabama and Tennessee. The officers of the company, which is incorporated under the state laws of Georgia, are W. J. Flannery, president; J. J. Smith, general manager, and Frank Kernan, secretary and treasurer. Extensive improvements are now being made at the above address and it is expected to open about Feb. 15. Some of the largest and best known manufacturers of electrical material in the country will be represented.

TRUMP TURBINES IN HIGH-HEAD PLANT.—Three 750-hp turbines, direct-connected to Westinghouse alternators, will constitute the total hydroelectric equipment for the plant of the Northern Ohio Power Company now under construction at Akron, Ohio. Reference to this plant was made in the issue of the *Electrical World* for Jan. 6, 1912, page 31, in which it was stated that the units would operate under a head of 102 ft., the highest hydraulic head under which turbines are operated in Ohio and probably throughout the Central States. The turbines will be furnished by the Trump Manufacturing Company, of Springfield, Ohio, and will be of its standard high-head type, the gate mechanism being of phosphor bronze. The wheels will be single units, their end thrust being taken care of entirely by automatic water cushion. They will be governed by Woodward oil-pressure governors.

MR. J. W. ARCHER will succeed to the business heretofore carried on by the firm of MacGovern, Archer & Company, which was dissolved by mutual consent on Dec. 31. The assets, good-will, machinery, existing contracts, warehouses, etc., of the late firm were taken over, and the business will be conducted along the same lines as in the past at the same location, namely, 114 Liberty Street. The members of the new firm are J. W. Archer and George M. Baldwin. Mr. Archer is well known to the trade through his connection of three years and a half with the firm recently dissolved and twelve years with Rossiter, MacGovern & Company. Mr. Baldwin, who is a mechanical engineer, was for a long time connected with the Bass Foundry & Machine Company, Fort Wayne, Ind., first in the manufacturing and designing part of the business and later in the sales department at New York. After a connection of three years with Rossiter, MacGovern & Company, as directing engineer, he opened an office as an independent consulting engineer in New York, and later, upon the organization of MacGovern, Archer & Company, became financially interested in that firm and was appointed in charge of its sales department.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 2, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,013,108. ELECTRICAL APPARATUS; J. M. Barr, Pittsburgh, Pa. App. filed July 17, 1905. Voltage regulation by transferring parts of coil windings from one part of a core to another.

1,013,112. TELEPHONE ATTACHMENT; G. L. Bennett, New York, N. Y. App. filed March 2, 1909. For holding the receiver of a desk set in different positions.

1,013,119. SINGLE-PHASE MOTOR; W. J. Branson, Wilkinsburg, Pa. App. filed Sept. 8, 1908. An auxiliary winding for starting without changing the circuit connections.

1,013,123. ELECTRIC MEASURING INSTRUMENT; H. W. Brown, Wilkinsburg, Pa. App. filed Jan. 21, 1909. Differential voltmeter with a plurality of ohmic resistance and a single movable coil.

1,013,124. MACHINE FOR MAKING INCANDESCENT LAMPS; W. R. Burrows, Newark, N. J. App. filed May 23, 1906. Automatic exhausting and sealing-off.

1,013,133. SYSTEM OF ELECTRICAL DISTRIBUTION; F. Darlington, Pittsburgh, Pa. App. filed June 25, 1906. Safety ground for railway work. The conductor is divided into sections.

1,013,135. INCANDESCENT-LAMP SOCKET; E. C. De Reamer, Schenectady, N. Y. App. filed Feb. 14, 1907. Shell lock.

1,013,149. ELECTRIC MOTOR; J. D. Forrer, Pittsburgh, Pa. App. filed Jan. 10, 1908. Ball-bearing armature construction.

1,013,150. TRANSFORMER; C. Le G. Fortescue, Wilkinsburg, Pa. App. filed Nov. 19, 1908. A laminated core with eccentric coil-receiving opening.

1,013,157. RESISTANCE OR HEATING ELEMENT; W. S. Hadaway, Jr., East Orange, N. J. App. filed May 1, 1909. Zigzag-folded slotted strip of metal.

1,013,166. LIGHTNING ARRESTER; R. B. Ingram, Wilkinsburg, Pa. App. filed June 25, 1906. A conducting shield extends beside some of a series of air-gaps to prevent condenser action.

1,013,167. ELECTRIC CIRCUIT INTERRUPTER; R. P. Jackson, Wilkinsburg, Pa. App. filed March 3, 1906. Electro-pneumatically operated switch for electric-vehicle motors.

1,013,186. SYSTEM OF ELECTRICAL DISTRIBUTION; P. M. Lincoln, Pittsburgh, Pa. App. filed Jan. 30, 1909. Automatic section cut-out.

1,013,189. ELECTRIC FURNACE; F. Louvrier, Mexico, Mexico. App. filed Sept. 22, 1910. Bottom and side electrodes.

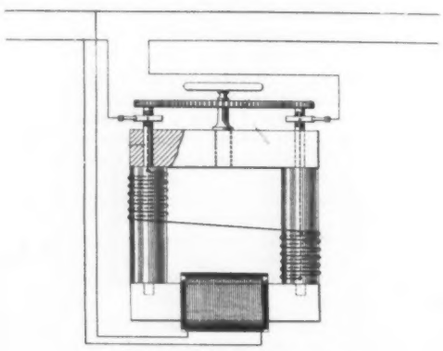
1,013,216. DYNAMO-ELECTRIC MACHINE; C. A. Psilander, Pittsburgh, Pa. App. filed Jan. 16, 1906. Ventilated railway motor.

1,013,218. INDUCTION MOTOR; W. E. Reed, Pittsburgh, Pa. App. filed Aug. 2, 1906. Short-circuiting current collectors.

1,013,223. DETECTOR; F. G. Sargent, Westford, Mass. App. filed Jan. 28, 1910. A suspended vibratory wire contactor.

1,013,227. MOUNTING TUNGSTEN FILAMENTS; C. F. Scott, Pittsburgh, Pa. App. filed Dec. 22, 1908. The filaments are loosely supported.

1,013,241. INSULATOR, F. C. Van Etten, Davenport, Ia. App. filed Oct. 16, 1911. Three rotatable sectors.



1,013,108—Electrical Apparatus.

1,013,250. INSULATOR PIN; W. J. Wilson, Pittsburgh, Pa. App. filed Oct. 19, 1910. A sheet-metal strip folded and formed into a tube.

1,013,270. SYSTEM OF ELECTRICAL DISTRIBUTION; R. Braun, Manchester, England. App. filed May 21, 1906. Two asynchronous connected machines for equalizing variable loads such as rolling mills, shear hoists, etc.

1,013,290. ELECTRICALLY CONTROLLED SEMAPHORE; E. R. Gill, Yonkers, N. Y. App. filed July 27, 1907. Single-wire railway system superposed on a telegraph circuit.

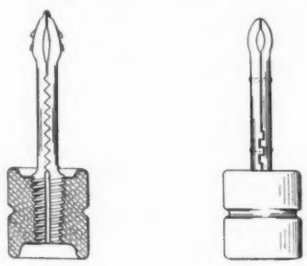
1,013,305. GROUNDING DEVICE FOR ELECTRICAL CONDUCTORS; F. W. Pardee, Evanston, Ill. App. filed Jan. 15, 1910. Perforated core with projections.

1,013,327. ELECTRIC HEATER; R. Smith, Cleveland, Ohio. App. filed Sept. 13, 1911. Casing for a lamp made with a window.

1,013,331. DEVICE FOR CONTROLLING THE SYNCHRONISM OF TWO MOTORS; F. E. Thormeyer, Hamburg, Germany. App. filed April 12, 1911. For driving a kinematograph and a phonograph. Improvement on Patent No. 989,207.

1,013,352. ARC-LAMP CONSTRUCTION; M. J. Wohl and H. Hertsberg, New York and Brooklyn, N. Y. App. filed May 29, 1908. Globe support.

1,013,359. ELECTRIC FURNACE; M. Appel, Baltimore, Md. App. filed Sept. 9, 1911. Resistance type mounted for oscillation and having a plurality of metal baths.



1,013,250.—Insulator Pin.

1,013,409. TRIMMER AND GAGE FOR ARC LAMPS; A. A. Low, H. Hertzberg and M. J. Wohl, Horseshoe and New York, N. Y. App. filed Dec. 24, 1909. A hand tool for replacing carbons.

1,013,412. PARTY-LINE TELEPHONE SYSTEM; A. Marchand, Bridgeport, Wash. App. filed March 3, 1909. Automatic selection, indication lock-out and restoration.

1,013,434. ELECTRIC-LAMP SOCKET; M. Peaucellier, Paris, France. App. filed Oct. 17, 1910. Sign body of cement with reinforcement serving as conductors.

1,013,445. METHOD OF MANUFACTURING ELECTRODES; H. Rodman, Pittsburgh, Pa. App. filed April 8, 1907. Barium-lead alloy electrode for storage batteries.

1,013,494. ELECTROMOTOR; B. F. Hutches, Jr., Allendale, N. J. App. filed May 19, 1910. Spring connection between a vibrating armature and the driving shaft.

1,013,502. PROCESS FOR THE MANUFACTURE OF GLYCOLIC ACID; O. Liebknecht, Frankfort-on-the-Main, Germany. App. filed March 1, 1911. Electrolytic reduction of oxalic acid.

1,013,542. LAMP; E. H. Ford, Hartford City, Ind. App. filed July 9, 1909. For reading meters at the bottom of manholes, etc.

1,013,569. ELECTRIC SWITCH; P. L. Sibole, Swissvale, Pa. App. filed Dec. 20, 1910. Electromagnetic simplification of Patent No. 977,140.

1,013,572. METHOD OF SHAPING FILAMENTS; R. W. Suman, Newark, N. J. App. filed May 31, 1911. The filament is wound zigzag on two pegs into a figure 8, heated to set and removed.

1,013,599. INCANDESCENT FILAMENT; D. Hand, Newark, N. J. App. filed Feb. 19, 1908. Carbon is mixed with NaCl flux and the Cl driven out by heat.

1,013,658. ELECTRIC-LAMP SOCKET; A. L. Jacobs, Boston, Mass. App. filed May 16, 1910. Two-piece porcelain with double-break switch.

1,013,673. TROLLEY POLE; M. Melinski, Albert City, Ia. App. filed July 3, 1911. Adjustable from the inside of the car.

1,013,681. LAMP SOCKET; R. W. Osland and M. J. Huggins, Plainfield, N. J., and Brooklyn, N. Y. App. filed May 19, 1909. Two-piece porcelain held together by a key.

1,013,700. SILICON CARBIDE; F. J. Tone, Niagara Falls, N. Y. App. filed Nov. 1, 1905. Carbonaceous material and a silicon material are heated together to form the carbide *in situ*.

1,013,701. MANUFACTURE OF SILICON CARBIDE; F. J. Tone, Niagara Falls, N. Y. App. filed July 10, 1908. Silicon carbide and silicon.

1,013,753. SQUIRREL-CAGE ROTOR FOR ELECTRIC MOTORS; G. Dunn, East Orange, N. J. App. filed April 12, 1910. Self-cooling laminated core.

1,013,754. ELECTRIC CONTROLLER; A. C. Eastwood, Cleveland, Ohio. App. filed Sept. 22, 1910. Individual, interlocked, magnetically operated switches.

1,013,767. MEANS FOR PREVENTING MOISTURE FROM ENTERING TRANSFORMER TANKS; F. W. Hadley, Atlanta, Ga. App. filed March 22, 1911. Oil seal with an air lock.

1,013,780. CENTRIFUGAL SWITCH FOR ALTERNATING-CURRENT MOTORS; T. Kargau, Warren, Ohio. App. filed Feb. 2, 1911. Fan motor starting switch.

1,013,854. THERMOSTAT; G. P. Wild, Philadelphia, Pa. App. filed Dec. 7, 1910. For controlling the charging of storage batteries.